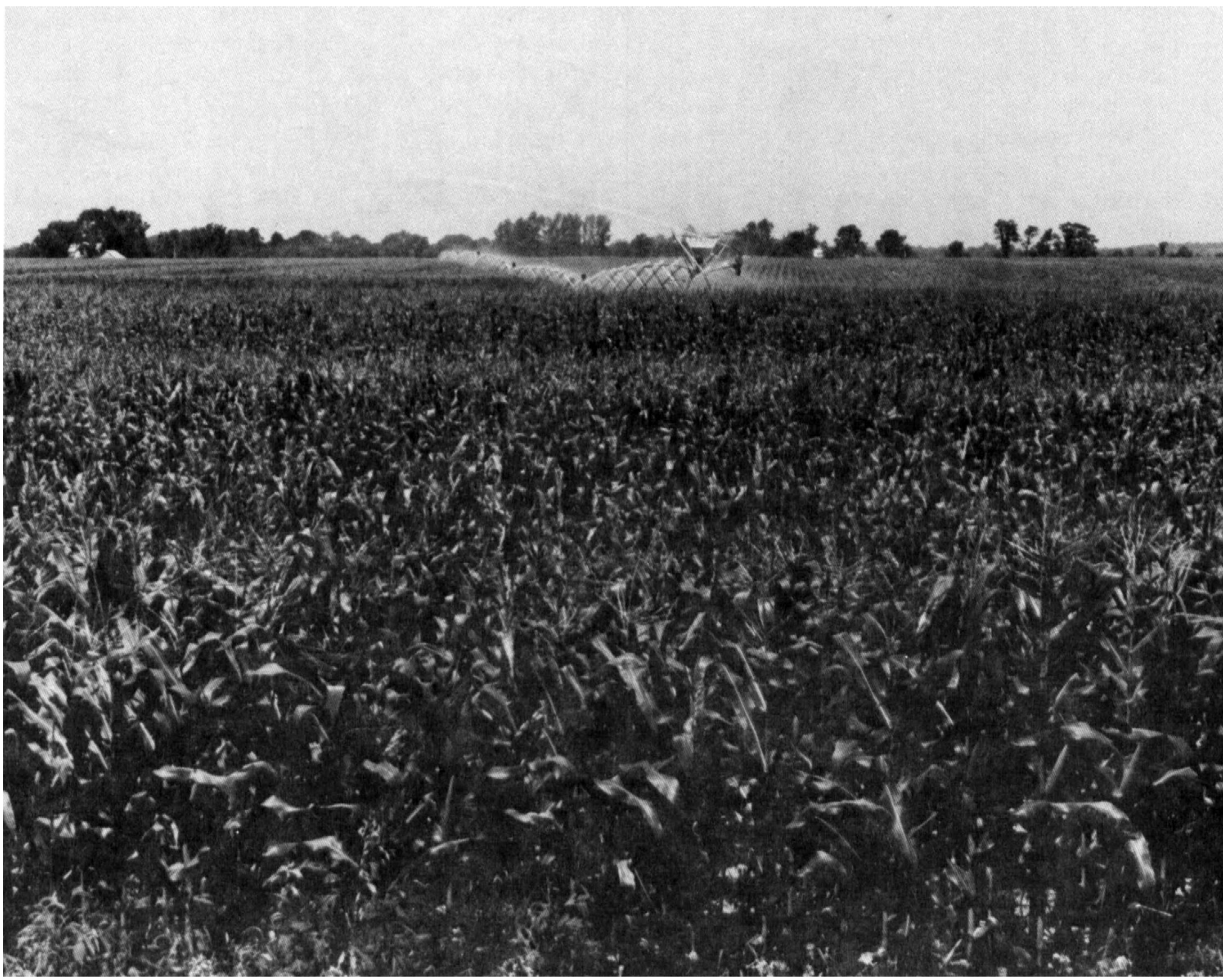
United States
Department of
Agriculture

Soil
Conservation
Service

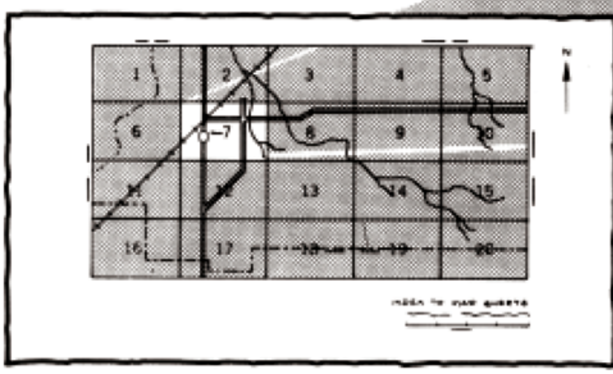
In cooperation with
Purdue University
Agricultural Experiment
Station, and Indiana
Department of Natural
Resources, Soil and Water
Conservation Committee

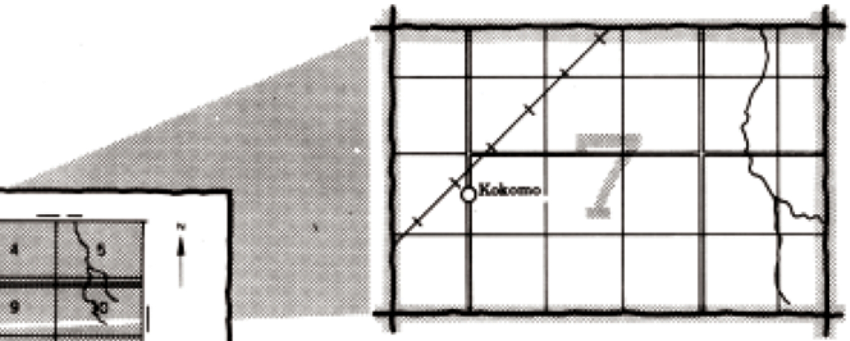
Soil Survey of Fulton County, Indiana



HOW TO USE

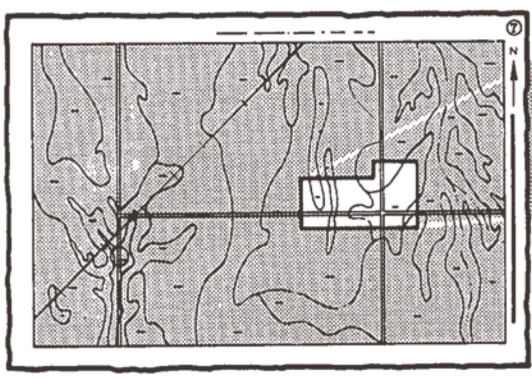
1. Locate your area of interest on the "Index to Map Sheets"

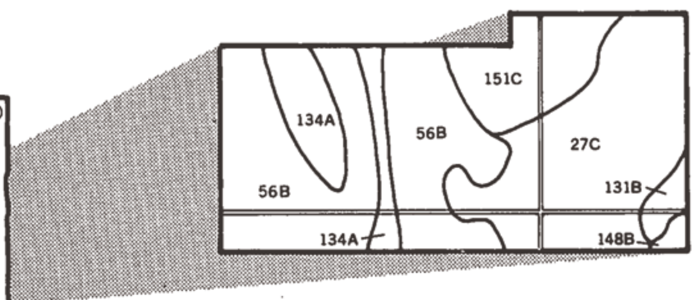




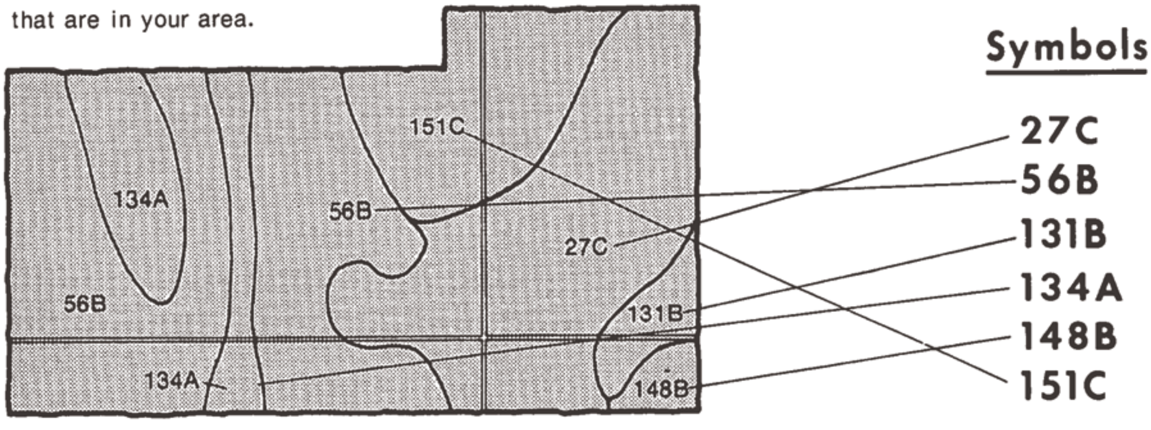
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



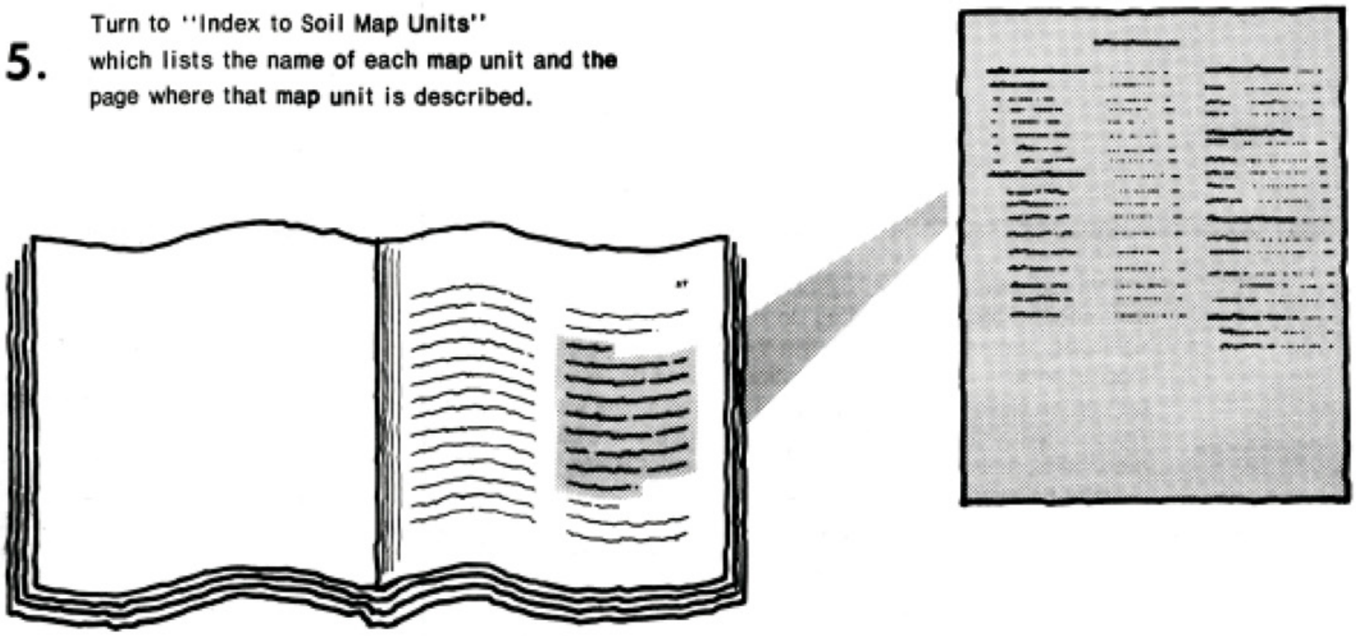


4. List the map unit symbols that are in your area.

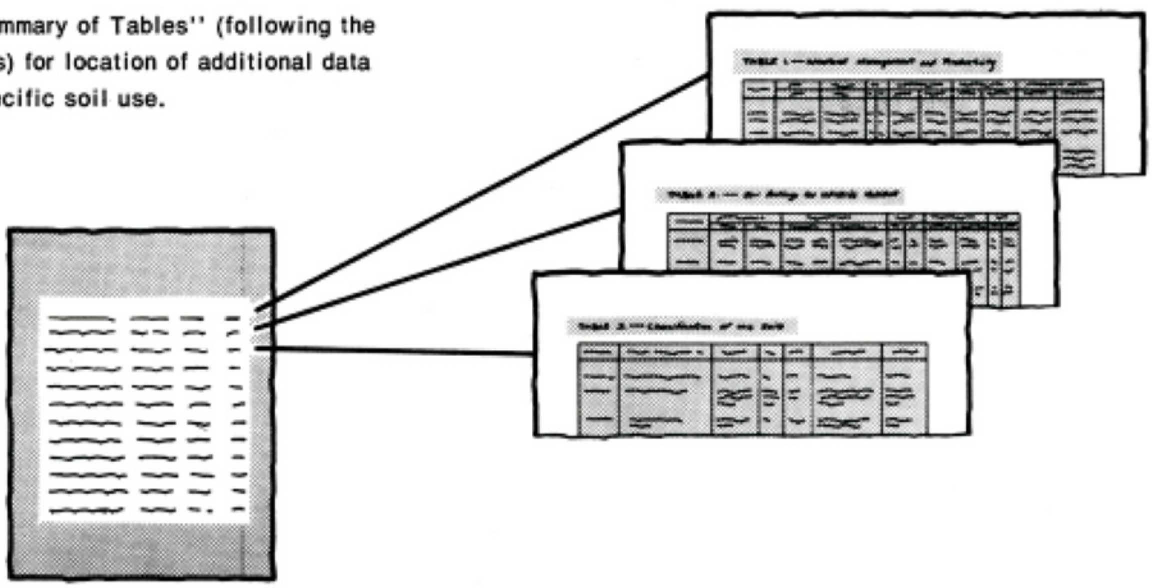


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This survey was made cooperatively by the Soil Conservation Service, the Purdue University Agricultural Experiment Station, and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Fulton County Soil and Water Conservation District. Financial assistance was made available by the Indiana Department of Natural Resources, Soil and Water Conservation Committee, and by the Fulton County Board of Commissioners.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: An irrigated area of Brems soils used for corn.

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Soil Series

Issued July 1987

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Fulton County, Indiana. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Robert L Eddleman

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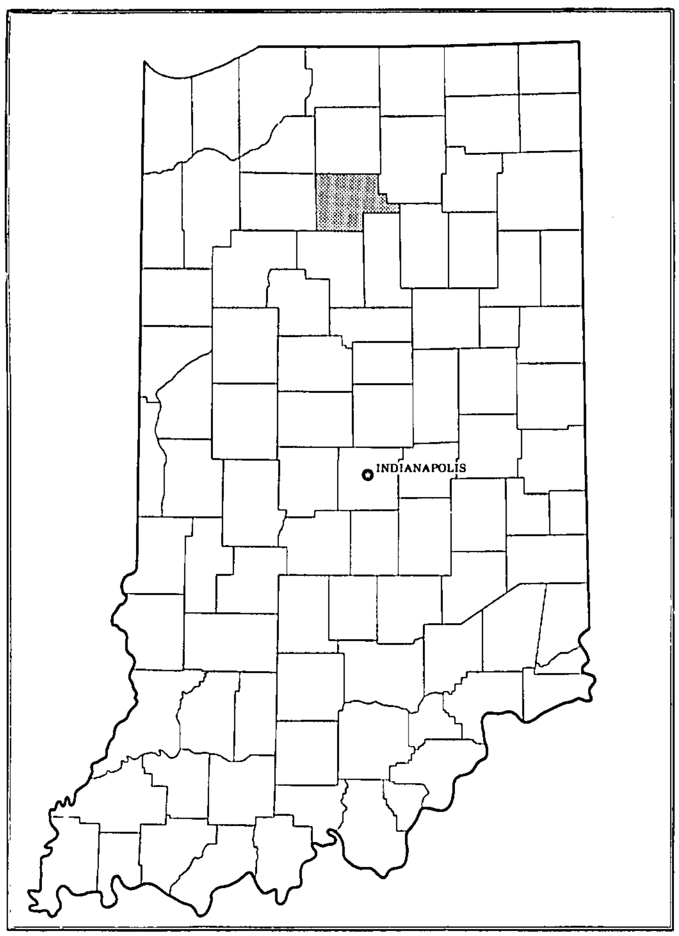
State Conservationist
Soil Conservation Service



Location of Fulton County in Indiana.

Soil Survey of
Fulton County, Indiana

By G. Franklin Furr, Jr., Soil Conservation Service

Fieldwork by G. Franklin Furr, Jr., Soil Conservation Service, and
William K. Schumacher, Indiana Department of Natural Resources,
Soil and Water Conservation Committee

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
Purdue University Agricultural Experiment Station and Indiana Department
of Natural Resources, Soil and Water Conservation Committee

FULTON COUNTY is in the north-central part of Indiana. It has an area of 237,709 acres, or about 371 square miles. Rochester, the county seat, is in the central part of the county.

The first permanent settlement in what is now Fulton County was established near Lake Manitou in 1830. More settlements were subsequently established by settlers from the East and Southeast. The county was organized on January 23, 1836.

About 70 percent of the county is farmed (*4*). Corn, soybeans, and wheat are the principal crops. A few areas are used for truck crops. The county had 1,104 farms in 1974. The average size of the farms was 186 acres. Agriculture is the main source of income and employment in the county. The businesses and industries in the county are relatively small.

This soil survey updates the soil survey of Fulton County published in 1946 (*3*). It provides additional information and larger maps, which show the soils in greater detail.

General Nature of the County

General features that affect soil use in Fulton County are described in the following paragraphs. These features are climate, relief and drainage, water supply, transportation facilities, manufacturing and business services related to agriculture, and trends in population and land use.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Fulton County is cold in winter but quite hot in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. The normal annual precipitation is adequate for all of the crops that are suited to the temperature and growing season in the county.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Rochester, Indiana, in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 26 degrees F, and the average daily minimum temperature is 17 degrees. The lowest temperature on record, which occurred at Rochester on January 29, 1963, is -23 degrees. In summer the average temperature is 68 degrees, and the average daily maximum temperature is 81 degrees. The highest recorded temperature, which occurred on September 2, 1953, is 101 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop

between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 37 inches. Of this, about 23 inches, or more than 63 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 4.72 inches at Rochester on April 29, 1956. Thunderstorms occur on about 40 days each year. Tornadoes and severe thunderstorms strike occasionally. These storms are usually local in extent and of short duration and cause damage in scattered areas.

The average seasonal snowfall is about 25 inches. The greatest snow depth at any one time during the period of record was 11 inches. On the average, 18 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

Relief and Drainage

The highest elevation in Fulton County is 900 feet above sea level, and the lowest point is 715 feet. The average elevation is about 760 feet.

Relief throughout the county ranges from nearly level or depressional to strongly sloping. The southern and the northeastern parts of the county consist of a smooth to gently undulating till plain that has very few natural drainageways. Excess water is removed from most soils by an elaborate system of subsurface drains and open ditches. Southwest of the central part of the county is an area of soils that are generally underlain by gravel and coarse sand.

The soils in the extreme southeast part of the county have more clay in the subsoil than those in other parts of the county. This area ranges from nearly level to strongly sloping. Relief changes abruptly within short distances. Many depressional areas have small lakes or are mucky. Several gravel pits are in this area, especially at the end points of some ridges.

The north-central part of the county, directly north of the Tippecanoe River, is a rolling morainic area, which is highly dissected and eroded. This area has many gravelly pockets, some of which have been or are used as gravel pits. North of this area is a nearly level to moderately sloping ground moraine, which has a few abrupt changes in relief.

Outwash soils, alluvial soils, and mucks are along the Tippecanoe River and its tributaries, around Lake Manitou, and along the tributaries that empty into the lake.

Water Supply

Ground water is the main source of water in Fulton County. Adequate supplies generally are available for household, farmstead, and light industrial uses. Irrigation water is drawn from some open ditches and from wells in the outwash areas.

Transportation Facilities

Fulton County has 143 miles of highways, including 16 miles of U.S. highways and 127 miles of state highways. It has 797 miles of county roads, of which about 85 percent are paved. The major highways provide good access to all parts of the county. An airport at Rochester serves small private airplanes. Two main railroads cross the county on approximately 30 miles of track. They offer only freight service in Fulton County.

Manufacturing and Business Services Related to Agriculture

Rochester has several different industries. Most of these are fairly small. A milk-processing plant and an elevator that packages birdseed are located in Rochester. A fertilizer-manufacturing plant is located in the small town of Fulton. A sawmill and lumber-products plant is located in Akron. Other small industries are located in Akron, Kewanna, Leiters Ford, and Talma. Many chemical, fertilizer, and seed suppliers are throughout the county.

Grain is sold through local elevators and to the major markets in nearby cities and towns. The major markets for hogs are Logansport and Topeka, Indiana. Cattle are sold locally or through nearby markets. Milk from the dairy farms is processed locally in Rochester or is shipped to nearby towns for processing.

Trends in Population and Land Use

Fulton County had a population of 17,453 in 1900; 15,577 in 1940; 16,984 in 1970; and 19,208 in 1980 (*7*). In 1940, the population of Rochester was 3,835; in 1970, it was 4,631; and in 1980, it was 5,016. The major concentration of population is in and near Rochester, the largest town in the county. Some of the population is concentrated around the other small towns in the county.

During the period of 1958 to 1967, the acreage of land under urban development increased by about 15 percent and all categories of agricultural land decreased by the same amount. In 1974, approximately 87 percent of the county remained agricultural land. At present, approximately 100 acres or less is being converted to

urban uses each year. This trend in expected to continue at a similar rate for several years.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The names, descriptions, and delineations of the soils on the general soil map of Fulton County do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

Soil Descriptions

Areas Dominated by Nearly Level, Very Poorly Drained and Poorly Drained Soils on Outwash Plains, Till Plains, and Lake Plains

These soils are in upland depressions in the central part of the county. They make up about 14 percent of the county. Most areas are drained and are used for cultivated crops. The major management concerns are wetness and ponding. In most areas the soils are unsuitable for urban uses because of the ponding.

1. Gilford-Barry Association

Nearly level, very poorly drained and poorly drained soils formed in loamy and sandy sediments and glacial till; on uplands

This association is in large areas in the central part of the county. Most areas are drained by open ditches and subsurface drains. Slopes range from 0 to 2 percent.

This association makes up about 14 percent of the county. It is about 50 percent Gilford and similar soils, 20 percent Barry soils, and 30 percent minor soils.

The very poorly drained Gilford soils are in broad areas on outwash plains and lake plains. Typically, they have a surface layer of black fine sandy loam and a subsoil of dark grayish brown and grayish brown, mottled sandy clay loam, sandy loam, and loamy sand. In some areas the underlying material is loamy.

The poorly drained Barry soils are in broad areas on till plains. Typically, they have a surface layer of black loam and a subsoil of dark gray and gray, mottled sandy clay loam and fine sandy loam.

The minor soils in this association are the Brady, Crosier, Morocco, Brems, Chelsea, Plainfield, Adrian, and Houghton soils. The somewhat poorly drained Brady, Crosier, and Morocco and moderately well drained Brems soils are in the slightly higher areas. The excessively drained Chelsea and Plainfield soils are on the higher knolls and ridges. The very poorly drained, organic Adrian and Houghton soils are in the deeper depressions.

Most of this association has been cleared and is used for cultivated crops. Most areas have been drained. The swampy areas and sandy ridges generally are used for woodland or pasture. If adequately drained, the major soils are suited to cultivated crops. Ponding and wetness are the main management concerns. Ponding is common in winter and spring (fig. 1).

The major soils are poorly suited to trees. The only species that can grow well are those that can withstand the wetness. Because of the ponding, harvesting is restricted to extremely dry periods or to periods when the ground is frozen.

This association is generally unsuitable for sanitary facilities and building site development. The ponding is the main hazard. Also, the effluent from waste disposal facilities in most areas of the Gilford soils can pollute ground water because the underlying material has a poor filtering capacity.

Areas Dominated by Nearly Level to Moderately Sloping, Well Drained Soils on Outwash Plains and Terraces

These soils are in the eastern part of the county. They make up about 15 percent of the county. They are used mainly for cultivated crops. The main management

Figure 1.—Ponding in an area of Barry soils.

concerns are droughtiness and erosion. In most areas the soils are well suited to building site development.

2. Kosciusko-Ormas Association

Nearly level to moderately sloping, well drained soils formed in loamy and sandy outwash and eolian material; on uplands

This association is in large areas on outwash plains and terraces in the eastern part of the county. Slopes range from 0 to 12 percent.

This association makes up about 15 percent of the county. It is about 40 percent Kosciusko and similar soils, 15 percent Ormas soils, and 45 percent minor soils.

Typically, the Kosciusko soils have a surface layer of very dark grayish brown fine sandy loam. The subsoil is dark brown sandy clay loam, sandy loam, and gravelly sandy clay.

Typically, the Ormas soils have a surface layer of dark brown loamy sand and a subsurface layer of yellowish brown sand and brownish yellow fine sand. The subsoil is dark yellowish brown fine sandy loam and loamy sand.

The minor soils in this association are the somewhat poorly drained Brady and Homer soils in the slightly lower areas and the very poorly drained Gilford and Sebewa soils in depressional areas and along poorly defined drainageways.

Most of this association has been cleared and is used for cultivated crops. The main management concerns are droughtiness and erosion.

The major soils are well suited to trees. Plant competition is the main management concern.

This association is suitable for building site development but is poorly suited to sanitary facilities. The effluent from waste disposal facilities can pollute ground water because the underlying material has a poor filtering capacity.

Areas Dominated by Nearly Level to Moderately Sloping, Excessively Drained, Well Drained, and Very Poorly Drained Soils on Outwash Plains, Terraces, and Lake Plains

These soils are on uplands in the northwestern part of the county. They make up about 9 percent of the county. Most areas are used for cultivated crops. Some are used as woodland. The main management concerns are droughtiness, erosion, and ponding. The soils are well suited to building site development.

3. Plainfield-Ormas-Newton Association

Nearly level to moderately sloping, excessively drained, well drained, and very poorly drained soils formed in loamy and sandy outwash and eolian material; on uplands

This association is in nearly level to gently sloping areas on outwash plains and in nearly level to moderately sloping areas on ridges covered by windblown sand. Areas are large. They are in the northwestern part of the county. Many are irrigated. Slopes range from 0 to 12 percent.

This association makes up about 9 percent of the county. It is about 25 percent Plainfield soils, 20 percent Ormas soils, 15 percent Newton soils, and 40 percent minor soils.

The excessively drained Plainfield soils are in broad, nearly level areas and in gently sloping and moderately sloping areas on ridges. Typically, they have a surface layer of very dark brown sand and a subsoil of dark yellowish brown sand.

The well drained Ormas soils are in broad, nearly level areas and in some gently sloping and moderately sloping areas. Typically, they have a surface layer of dark brown loamy sand and a subsurface layer of yellowish brown sand and brownish yellow fine sand. The subsoil is dark yellowish brown fine sandy loam and loamy sand.

The very poorly drained Newton soils are in broad, low lying, nearly level areas. Typically, they have a surface layer of black fine sandy loam and a subsurface layer of black loamy sand.

The minor soils in this association are Brems, Chelsea, Morocco, and Metea soils. The moderately well drained, nearly level Brems soils are in the slightly lower areas. The excessively drained Chelsea soils are in landscape positions similar to those of the Plainfield and Ormas soils. The somewhat poorly drained Morocco soils are in low lying areas. The well drained Metea soils are on slight ridges.

Most of this association has been cleared and is used for cultivated crops. The main management concerns are droughtiness, the hazard of erosion, and ponding. The areas that have not been cleared are swampy and are not drained. These areas support mostly water-tolerant trees.

The major soils are suitable for trees. Seedling mortality is the main management concern.

This association is poorly suited to sanitary facilities. The effluent from waste disposal facilities can pollute ground water. The Plainfield and Ormas soils are suitable for building site development, but the Newton soils generally are unsuitable because of ponding.

Areas Dominated by Nearly Level to Moderately Sloping, Somewhat Poorly Drained and Well Drained Soils on Lake Plains, Till Plains, and Moraines

These soils are in the western part of the county. They make up about 11 percent of the county. They are used mainly for cultivated crops. The main management concerns are wetness, soil blowing, and water erosion. In most areas the soils are fairly well suited to urban uses.

4. Markton-Metea Association

Nearly level to moderately sloping, somewhat poorly drained and well drained soils formed in sandy material overlying loamy glacial till; on uplands

This association is on lake plains, till plains, and moraines. Most areas are drained by small streams. Slopes range from 0 to 12 percent.

This association makes up about 11 percent of the county. It is about 35 percent Markton and similar soils, and 30 percent Metea soils, and 35 percent minor soils.

The somewhat poorly drained, nearly level Markton soils are on broad lake plains and till plains. Typically, they have a surface layer of very dark grayish brown loamy sand and a subsoil of yellowish brown fine sand; dark brown, mottled loamy sand and sandy loam; and grayish brown fine sandy loam.

The well drained, nearly level to moderately sloping Metea soils are on low knolls and side slopes on moraines and till plains. Typically, they have a surface layer of dark brown loamy sand, a subsurface layer of yellowish brown loamy sand, and a subsoil of dark yellowish brown fine sandy loam and loam.

The minor soils in this association are the excessively drained Chelsea and Plainfield soils on ridges, the poorly drained Barry soils in depressional areas and along poorly defined drainageways, and the somewhat poorly drained Crosier soils in nearly level areas.

Most of this association has been cleared and is used for cultivated crops. The main management concerns are wetness, soil blowing, and water erosion.

The major soils are suited to trees. Plant competition and seedling mortality are the main management concerns.

The higher lying Metea soils are suited to sanitary facilities, but the lower lying Markton soils are poorly suited because of wetness. This association is suitable for building site development.

Areas Dominated by Nearly Level to Strongly Sloping, Somewhat Poorly Drained, Poorly Drained, and Well Drained Soils on Till Plains and Moraines

These soils are on uplands throughout the county. They make up about 48 percent of the county. Most areas are used for cultivated crops. Some are used as woodland. The main management concerns are erosion, wetness, and ponding. The soils are fairly well suited to urban uses.

5. Crosier-Barry Association

Nearly level, somewhat poorly drained and poorly drained soils formed in loamy glacial till; on uplands

This association is on till plains and moraines that are characterized by a gentle swale and swell topography. Most areas are drained by small streams and by some ditches. Slopes range from 0 to 2 percent.

This association makes up about 24 percent of the county. It is about 45 percent Crosier and similar soils, 30 percent Barry soils, and 25 percent minor soils.

The somewhat poorly drained Crosier soils are in the higher, broad, slightly convex areas and on slight rises. Typically, they have a surface layer of dark grayish brown loam and a subsoil of grayish brown and dark brown, mottled clay loam and loam.

The poorly drained Barry soils are in depressions and along poorly defined drainageways. Typically, they have a surface layer of black loam and a subsoil of black, dark gray, and gray, mottled loam, sandy clay loam, and fine sandy loam.

The minor soils in this association are the somewhat poorly drained Markton and well drained Metea soils on the slightly higher, broad flats and gently sloping rises.

Most of this association has been cleared and is used for cultivated crops. Most areas are drained. The undrained areas are used as woodland or pasture. If drained and cleared, the major soils are suited to cultivated crops. Wetness and ponding are the main management concerns.

The major soils are suited to trees. The species that can withstand wetness should be selected for planting. Because of the wetness and ponding, harvesting is restricted to dry periods or to periods when the ground is frozen.

This association is poorly suited to sanitary facilities and building site development. Moderately slow permeability, ponding, and wetness are the main limitations.

6. Wawasee-Crosier-Barry Association

Nearly level to strongly sloping, well drained, somewhat poorly drained, and poorly drained soils formed in loamy glacial till; on uplands

This association is on till plains and moraines. The moraines are characterized by knolls and ridges that vary in height, shape, and size. The till plains are characterized by gently sloping to strongly sloping areas along small creeks and drainageways and on small knolls and ridges. Most of the association is drained by small streams. Slopes range from 0 to 18 percent.

This association makes up about 11 percent of the county. It is about 40 percent Wawasee and similar soils, 25 percent Crosier soils, 20 percent Barry soils, and 15 percent minor soils.

The well drained, gently sloping to strongly sloping Wawasee soils are on till plains, knolls, and ridges and on side slopes around deep potholes and along drainageways. Typically, they have a surface layer of dark brown fine sandy loam and a subsoil of dark yellowish brown loam and sandy clay loam.

The somewhat poorly drained, nearly level Crosier soils are in broad, slightly convex areas and on slight rises. Typically, they have a surface layer of dark grayish brown loam and a subsoil of grayish brown and dark brown, mottled clay loam and loam.

The poorly drained, nearly level Barry soils are in depressions and along poorly defined drainageways. Typically, they have a surface layer of black loam and a subsoil of dark gray and gray, mottled sandy clay loam and fine sandy loam.

The minor soils in this association are the well drained, sandy Metea soils on knolls and on side slopes along drainageways.

Most of this association has been cleared and drained and is used for cultivated crops. The undrained areas are used as woodland or pasture. Most of the association is suited to cultivated crops. The main management concerns are ponding and wetness in

areas of the Crosier and Barry soils and the hazard of erosion on the more sloping Wawasee soils.

The major soils are suited to trees. The species that can withstand wetness should be selected for planting on the lower lying soils. The wetness of these soils restricts harvesting to dry periods or to periods when the ground is frozen.

The Crosier and Barry soils are poorly suited to sanitary facilities and building site development, mainly because of moderately slow permeability, ponding, and wetness. The gently sloping and moderately sloping Wawasee soils are suitable as sites for sanitary facilities and buildings.

7. Riddles-Crosier Association

Nearly level to moderately sloping, well drained and somewhat poorly drained soils formed in glacial till; on uplands

This association is on till plains and moraines that are characterized by a gentle swell and swale topography. Most areas are drained by small streams and by some ditches. Slopes range from 0 to 12 percent.

This association makes up about 10 percent of the county. It is about 55 percent Riddles and similar soils, 21 percent Crosier soils, and 24 percent minor soils.

The well drained, nearly level to moderately sloping Riddles soils are on ridges and on side slopes along drainageways. Typically, they have a surface layer of dark grayish brown fine sandy loam and a subsoil of dark yellowish brown and yellowish brown sandy clay loam.

The somewhat poorly drained, nearly level Crosier soils are in broad, slightly convex areas and on slight rises. Typically, they have a surface layer of dark grayish brown loam and a subsoil of grayish brown and dark brown, mottled clay loam and loam.

The minor soils in this association are the poorly drained Barry soils in depressions and along poorly defined drainageways and the well drained, sandy Metea soils on knolls and ridges and on side slopes along drainageways.

Most of this association has been cleared and is used for cultivated crops. The drained, cleared areas of Crosier soils and the cleared areas of Riddles soils are suited to cultivated crops. Erosion is a hazard on the more sloping soils.

The major soils are suited to trees. Plant competition is the main management concern.

The Crosier soils are poorly suited to sanitary facilities and building site development because of wetness. The Riddles soils are suitable as sites for sanitary facilities and buildings.

8. Crosier-Wawasee-Metea Association

Nearly level to strongly sloping, well drained and somewhat poorly drained soils formed in loamy glacial till and eolian material; on uplands

This association is on till plains and moraines. The moraines are characterized by knolls and ridges that vary in height, shape, and size. The till plains are characterized by gently sloping to strongly sloping areas along small creeks and drainageways and on small knolls and ridges. Most of the association is drained by small streams. Slopes range from 0 to 18 percent.

This association makes up about 3 percent of the county. It is about 30 percent Crosier and similar soils, 25 percent Wawasee soils, 20 percent Metea soils, and 25 percent minor soils.

The somewhat poorly drained, nearly level Crosier soils are in broad, slightly convex areas and on slight rises. Typically, they have a surface layer of dark grayish brown loam and a subsoil of grayish brown and dark brown, mottled clay loam and loam.

The well drained, gently sloping to strongly sloping Wawasee soils are on till plains, knolls, and ridges and on side slopes around deep potholes and along drainageways. Typically, they have a surface layer of dark brown fine sandy loam and a subsoil of dark yellowish brown loam and sandy clay loam.

The well drained, nearly level to moderately sloping Metea soils are on till plains, knolls, ridges, and side slopes. Typically, they have a surface layer of dark brown loamy sand, a subsurface layer of yellowish brown loamy sand, and a subsoil of dark yellowish brown fine sandy loam and loam.

The minor soils in this association are the poorly drained Barry soils in depressions and along poorly defined drainageways and the excessively drained Chelsea soils on knolls and ridges and on side slopes along drainageways.

Most of this association has been cleared. The nearly level to moderately sloping soils are suited to cultivated crops. Erosion is a hazard in the more sloping areas, and wetness is a management concern in the less sloping areas.

The major soils are suited to trees. Plant competition and seedling mortality are the main management concerns.

The Crosier soils are poorly suited to sanitary facilities and building site development because of wetness. The Metea soils are suitable as sites for buildings, but they are severely limited as sites for sanitary facilities because of a poor filtering capacity. The gently sloping and moderately sloping Wawasee soils are suitable as sites for sanitary facilities and buildings.

Areas Dominated by Nearly Level to Moderately Sloping, Well Drained to Very Poorly Drained Soils on Till Plains and Moraines

These soils are on till plains and moraines in the eastern part of the county. They make up about 3 percent of the county. They are used mainly for cultivated crops. The main management concerns are

erosion, wetness, and ponding. In most areas the soils are fairly well suited to urban uses.

9. Morley-Blount-Pewamo Association

Nearly level to moderately sloping, well drained to very poorly drained soils formed in glacial till; on uplands

This association is on till plains and moraines that are characterized by a gentle swell and swale topography. Most areas are drained by small streams and by some ditches. Slopes range from 0 to 12 percent.

This association makes up about 3 percent of the county. It is about 55 percent Morley soils, 15 percent Blount soils, 15 percent Pewamo soils, and 15 percent minor soils.

The well drained and moderately well drained Morley soils are in gently sloping and moderately sloping areas on knolls, ridges, and side slopes. Typically, they have a surface layer of dark grayish brown loam and a subsoil of dark yellowish brown, yellowish brown, and brown clay and clay loam.

The somewhat poorly drained Blount soils are in nearly level areas. Typically, they have a surface layer of dark grayish brown loam and a subsoil of dark yellowish brown and brown, mottled clay and clay loam.

The very poorly drained Pewamo soils are in nearly level or depressional areas. Typically, they have a surface layer of very dark brown clay loam and a subsoil of dark gray, grayish brown, and gray clay.

The minor soils in this association are the well drained Riddles soils on knolls and side slopes and the very poorly drained Houghton soils in depressional areas.

Most of this association has been cleared and is used for cultivated crops. The main management concerns are ponding, wetness, and erosion.

The major soils are suited to trees. Plant competition, seedling mortality, and the windthrow hazard are the main management concerns.

Because of slow permeability and wetness, this association is poorly suited to sanitary facilities. It is suitable for building site development.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Plainfield sand, 2 to 6 percent slopes, is a phase in the Plainfield series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Kosciusko-Ormas complex, 2 to 6 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The names, descriptions, and delineations of the soils identified on the detailed soil maps of this county do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

Ad—Adrian muck, drained. This nearly level or depressional, deep, very poorly drained soil is in depressions on outwash plains, till plains, and moraines. In winter and spring, it is frequently ponded for brief periods by runoff from the higher lying adjacent areas. Individual areas are irregular in shape and are 3 to 60 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is black muck about 11 inches thick. Below this is about 16 inches of very dark brown muck. The underlying material to a depth of 60 inches is dark gray and very dark gray sand. In some places the muck is less than 16 or more than 51 inches thick. In other places alternating bands of organic material and sand are in the underlying material. In some areas coprogenous earth, marl, or loamy material underlies the organic layer. In a few small areas the organic material is very strongly acid.

Included with this soil in mapping are small areas of Adrian muck that have not been drained and small areas of the very poorly drained Newton soils, which do not have organic layers. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is very high in the Adrian soil. Permeability is moderately slow to moderately rapid in the organic material and rapid in the underlying sand. Surface runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The surface layer is strongly acid. The organic matter content is very high in the surface layer. This layer is friable, and tilth is good.

Most areas of this soil are used for cultivated crops. Some are pastured.

If drained, this soil is suited to corn and soybeans. Because of weeds and lodging, however, soybeans cannot be easily grown or harvested. Wetness and soil blowing are the major management concerns. The soil oxidizes and subsides when exposed to air after the water table is lowered. A controlled drainage system in which the water table is lowered during periods of planting, crop growth, and harvest and is raised during other periods is needed. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control soil blowing.

If drained, this soil is suited to grasses for hay or pasture. The major concern in managing pasture is overgrazing, which reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. Some small areas that are not drained are wooded. The water table near or above the surface is the main limitation. The equipment limitation, seedling mortality, plant competition, and the windthrow hazard are management concerns. Overcoming these limitations and hazards is difficult. The trees should be harvested when the ground is frozen.

Because of ponding and low strength, this soil is generally unsuitable as a site for dwellings. Because of the ponding and a poor filtering capacity, it is generally unsuitable as a site for septic tank absorption fields. It is severely limited as a site for local roads because of ponding, frost action, and low strength. Replacing the organic material with suitable base material improves the ability of the roads to support vehicular traffic. Building the roads on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to remove excess water and thus help to prevent the damage caused by ponding and frost action. If adequate outlets are not available for ditches, pumps are needed.

The land capability classification is IVw. The woodland ordination symbol is 2W.

Ah—Algansee loamy sand, frequently flooded. This nearly level, somewhat poorly drained soil is on flood plains. It is frequently flooded by stream overflow. Individual areas are elongated or circular and are 3 to 40 acres in size.

In a typical profile, the surface layer is very dark grayish brown loamy sand about 5 inches thick. The upper part of the underlying material is dark yellowish brown loamy sand. The next part is yellowish brown sand. The lower part to a depth of 60 inches is light brownish gray and yellowish brown, mottled sand. In some places the dark surface layer is more than 5 inches thick. In other places the soil has more clay throughout. In some areas gray mottles are directly below the surface layer. In other areas the lower part of the soil is brown and does not have gray mottles.

Included with this soil in mapping are some small areas of the poorly drained and very poorly drained Cohoctah soils in the lower swales. These soils make up about 3 to 5 percent of the unit.

Available water capacity is low in the Algansee soil. Permeability is rapid. Surface runoff is slow. The water table is at a depth of 1 to 2 feet during winter and spring. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are wooded. Some have been cleared of trees and are used for cultivated crops or for hay or pasture. The areas that have been cleared and are adequately protected from flooding are fairly well suited to corn and soybeans. A cropping sequence dominated by row crops can be used in the adequately protected areas. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing.

This soil is well suited to grasses and legumes for hay or pasture. It is less well suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. A drainage system and protection from flooding are needed. Overgrazing reduces plant density and plant hardiness and increases the susceptibility to the erosion caused by floodwater. Proper stocking rates, rotation grazing, and deferment of grazing during periods of crop stress help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality is the main management concern. The seasonal wetness and the flooding can slightly delay harvesting or planting. The species that can withstand wet conditions should be favored in the stands. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the flooding, a poor filtering capacity, and the wetness, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the hazard of flooding. Overcoming this hazard is difficult because the floodwater is overflow from rising streams. Building the roads on raised, well compacted fill material and installing culverts help to prevent the damage caused by flooding.

The land capability classification is IIIw. The woodland ordination symbol is 4S.

Bb—Barry loam. This nearly level or depressional, deep, poorly drained soil is in broad depressions, in swales, and in narrow drainageways on till plains. In winter and spring, it is frequently ponded for brief periods by runoff from the higher lying adjacent areas. Individual areas are dominantly oval or fingerlike and are 3 to 227 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is black loam about 10 inches thick. The subsurface layer also is black loam. It is about 3 inches thick. The subsoil is about 28 inches thick. The upper part is dark gray, mottled, firm sandy clay loam, and the lower part is gray, mottled, firm fine sandy loam. The underlying material to a depth of 60 inches is pale brown loam. In some places lighter colored soil material has been deposited over the original black surface layer. In other places the subsoil has lenses of loamy sand. In some areas the soil has more clay throughout. In other areas the slope is more than 2 percent.

Included with this soil in mapping are small, slightly convex areas of the somewhat poorly drained Crosier soils and small areas of the well drained Riddles and Wawasee soils. All of these included soils are in the higher landscape positions. Also included, on the lower parts of the landscape, are some small areas of soils that stay wet for long periods and may have a mucky surface layer. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is high in the Barry soil. Permeability is moderate. Surface runoff is very slow or ponded. The water table is near or above the surface in winter and early in spring. The organic matter content is high in the surface layer. This layer becomes cloddy and hard to work if tilled when too wet. Also, a compact plowpan can form if the soil is tilled when it is too wet. The plowpan can restrict root growth and lower yields.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and some small grain crops. It is poorly suited to winter wheat, however, because ponding usually destroys the stands. The wetness is the main limitation. Excess water can be removed by open ditches, subsurface drains, pumps, or a combination of these. If drained and otherwise well managed, the soil is suited to intensive row cropping. A system of conservation tillage that leaves all or part of the crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. It is less well suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. A drainage system is necessary. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent excessive compaction and maintain good tilth and plant density.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The trees are usually harvested only during extremely dry periods or when the ground is frozen. The species that can withstand the wetness should be favored in the stands. Because of seedling mortality, special planting stock and overstocking are needed. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling. Thinning or harvest methods that do not isolate the remaining trees or leave them too widely spaced reduce the windthrow hazard.

Because of ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of ponding and frost action. Building the roads on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to prevent the damage caused by ponding and frost action. Strengthening the base with better suited material improves the ability of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 5W.

BlA—Blount loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on till plains. Individual areas are irregular in shape and are 3 to 80 acres in size.

In a typical profile, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 30 inches thick. The upper part is dark yellowish brown, mottled, firm clay, and the lower part is brown and dark yellowish brown, mottled, firm clay and clay loam. The underlying material to a depth of 60 inches is brown and dark gray, mottled clay loam. In some places the depth to the underlying material is less than 20 inches. In other places the soil has more sand throughout. In some areas the slope is more than 2 percent.

Included with this soil in mapping are some small areas of the well drained Morley soils on the slightly higher parts of the landscape and some small areas of the very poorly drained Pewamo soils in slight depressions and along drainageways. Included soils make up about 3 to 10 percent of the unit.

Available water capacity is moderate in the Blount soil. Permeability is slow or moderately slow. Surface runoff is slow. The water table is at a depth of 1 to 3 feet during winter and spring. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a moderate range in moisture content. A compact plowpan can form if the soil is tilled when it is too wet. The plowpan can restrict root growth and lower yields.

Most areas of this soil are drained by subsurface and surface drains and are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. The wetness is the main limitation. Row crops can be grown in most years. Because of puddling, the soil should not be worked when wet. A system of conservation tillage that leaves all or part of the crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as clover and alfalfa, for hay or pasture. It is less well suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. A drainage system is necessary. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent excessive compaction and maintain good tilth and plant density.

This soil is fairly well suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Because of seedling mortality, some replanting may be necessary. Also, special planting stock and overstocking are needed. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling. Thinning or harvest methods that do not isolate the remaining trees or leave them too widely spaced reduce the windthrow hazard. The seasonal wetness can slightly delay harvesting or planting. The species that can withstand wet conditions should be favored in the stands.

Because of the wetness, this soil is severely limited as a site for dwellings. It is better suited to dwellings without basements than to dwellings with basements. Subsurface drains help to lower the water table. Water moves slowly to drainage systems because of the restricted permeability.

This soil is severely limited as a site for local roads and streets because of frost action and low strength. Constructing roadside ditches that lower the water table and elevating the roadway reduce the potential for frost action. Strengthening or replacing the base material with better suited material improves the ability of the roads to support vehicular traffic.

Because of the wetness and the restricted permeability, this soil is severely limited as a site for septic tank absorption fields. Filling or mounding with suitable material improves the capacity of the field to absorb effluent. A drainage system around the outer edges of the absorption field helps to remove excess water.

The land capability classification is IIw. The woodland ordination symbol is 3C.

Br—Brady sandy loam. This nearly level, deep, somewhat poorly drained soil is on outwash plains. Individual areas are irregular in shape and are 5 to 50 acres in size. The dominant size is about 25 acres.

In a typical profile, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsoil is about 37 inches thick. In sequence downward, it is dark brown and dark grayish brown, mottled, friable sandy loam; dark grayish brown, mottled, firm gravelly sandy clay loam; grayish brown, friable coarse sandy loam; and brown, very friable loamy sand. The underlying material to a depth of 60 inches is pale brown and dark yellowish brown sand and coarse sand. In some places the depth to the underlying material is less than 40 inches. In other places the surface layer is brown. In some areas the subsoil and underlying material have more clay. In other areas the surface layer and subsoil have more sand and less clay. In places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained Gilford and Sebewa soils in the slightly lower landscape positions and some areas of the moderately well drained Branch and well drained Ormas soils in the slightly higher positions. Included soils make up about 5 to 12 percent of the unit.

Available water capacity is low in the Brady soil. Permeability is moderately rapid. Surface runoff is slow. The water table is at a depth of 1 to 3 feet during winter and spring. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and some are wooded.

This soil is well suited to corn, soybeans, and small grain. If drained, it is suitable for a cropping sequence dominated by row crops. The wetness is the major limitation. Also, soil blowing is a hazard during dry periods. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface improve or maintain tilth and the organic matter content and help to control soil blowing.

This soil is well suited to grasses, such as bromegrass, and shallow-rooted legumes, such as clover, for hay or pasture. It is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. A cover of pasture plants helps to control soil blowing. A drainage system is needed. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also increases the susceptibility to soil blowing because it reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet and very dry periods help to keep the pasture in good condition.

This soil is well suited to trees. The seasonal wetness can slightly delay planting or harvesting. Seedling

survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. It is better suited to dwellings without basements than to dwellings with basements. An adequate drainage system is needed to lower the water table. The soil is severely limited as a site for local roads and streets because of frost action. Constructing roadside ditches that lower the water table and raising the roadbed above the water table reduce the potential for frost action.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. Adding suitable fill material helps to ensure that the absorption field functions properly.

The land capability classification is IIw. The woodland ordination symbol is 5A.

BsA—Branch loamy sand, 0 to 2 percent slopes. This nearly level, deep, moderately well drained soil is on outwash plains. Individual areas are irregular in shape and are 3 to 150 acres in size. The dominant size is about 25 acres.

In a typical profile, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is dark brown and yellowish brown, very friable loamy sand about 13 inches thick. The subsoil is about 23 inches thick. The upper part is yellowish brown and dark yellowish brown, mottled, friable gravelly loamy sand and gravelly fine sandy loam, and the lower part is dark yellowish brown, mottled, very friable gravelly loamy sand. The underlying material to a depth of 60 inches is yellowish brown very gravelly loamy coarse sand. In places the sandy material in the upper part of the soil is less than 20 inches thick. In some areas the surface soil and subsoil have more clay. In other areas they have less clay. In places the slope is more than 2 percent.

Included with this soil in mapping are some small areas of the somewhat poorly drained Brady soils and some small areas of the very poorly drained Gilford soils in depressions and drainageways. Also included are small areas of the well drained Ormas soils on the higher parts of the landscape. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is moderate in the Branch soil. Permeability is moderately rapid in the subsoil and very rapid in the underlying material. Surface runoff is slow. The water table is at a depth of 2.0 to 3.5 feet during winter and spring. The organic matter content is moderate in the surface layer. This layer is very friable, and tilth is good.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is suited to corn, soybeans, and small grain. It is suitable for a cropping sequence dominated by row crops. Droughtiness is a problem during dry periods. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface increase or maintain the organic matter content, conserve moisture, and help to control soil blowing.

This soil is suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. Deep-rooted legumes and drought-tolerant grasses are suitable for hay or pasture. Shallow-rooted legumes, such as clover, are poorly suited because of the moderate available water capacity. Overgrazing increases the susceptibility to soil blowing and reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during dry periods help to keep the pasture in good condition.

This soil is suited to trees. Seedling mortality and plant competition are the main management concerns. Because of the seedling mortality rate, seedlings should be planted as early as possible in the spring. Also, special planting stock and overstocking are needed. Some replanting may be necessary. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is moderately limited as a site for dwellings without basements and is severely limited as a site for dwellings with basements. An adequate drainage system around footings is needed to lower the water table. The soil is moderately limited as a site for local roads and streets because of wetness and frost action. Constructing roadside ditches that lower the water table and elevating the roadbed reduce the wetness and the potential for frost action.

Because of the wetness and a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Adding suitable fill material helps to ensure that the absorption field functions properly.

The land capability classification is IIIs. The woodland ordination symbol is 3S.

BtA—Brems loamy sand, 0 to 3 percent slopes. This nearly level and gently sloping, deep, moderately well drained soil is on outwash plains. Individual areas are irregularly shaped or elongated and are 3 to 80 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark brown loamy sand about 12 inches thick. The subsoil is about 55 inches thick. The upper part is brownish yellow, very friable loamy fine sand; the next part is pale brown, loose fine sand; and the lower part is light yellowish brown and pale brown, mottled, loose fine sand. The underlying material to a depth of about 80 inches is brown fine sand. In some places the depth to the underlying material is less than 40 inches. In other places the underlying material is sandy loam below a

depth of 55 inches. In some areas the slope is more than 3 percent.

Included with this soil in mapping are some small areas of the somewhat poorly drained Brady soils. These soils are in landscape positions similar to those of the Brems soil. Also included are some small areas of the excessively drained Chelsea and Plainfield soils on the slightly higher parts of the landscape. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is low in the Brems soil. Permeability is rapid. Surface runoff is slow. The water table is at a depth of 2 to 3 feet during winter and spring. The surface layer generally is medium acid unless it is limed. The organic matter content is low in the surface layer. This layer is very friable, and tilth is good.

Some areas of this soil are used for cultivated crops. Some are used for hay or pasture, and some are wooded.

This soil is poorly suited to corn, soybeans, and small grain. Droughtiness and soil blowing are the main management concerns. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control soil blowing, increase or maintain the organic matter content, and conserve moisture.

This soil is fairly well suited to deep-rooted legumes, such as alfalfa, and drought-tolerant grasses, such as bromegrass, for hay or pasture. Shallow-rooted legumes, such as clover, are poorly suited because of the low available water capacity. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, and deferment of grazing during dry periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality is the main management concern. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling. Some replanting may be necessary.

Because of the wetness, this soil is moderately limited as a site for dwellings without basements and for local roads and streets and is severely limited as a site for dwellings with basements. A drainage system is needed to lower the water table. Because of the wetness and a poor filtering capacity, the soil is severely limited as a site for septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Adding suitable fill material helps to ensure that the absorption field functions properly.

The land capability classification is IVs. The woodland ordination symbol is 4S.

ChB—Chelsea fine sand, 2 to 6 percent slopes. This gently sloping, deep, excessively drained soil is on outwash plains. It is generally on convex summits, side slopes, and crests along the eastern side of stream valleys. Individual areas are irregularly shaped and are 3 to 18 acres in size.

In a typical profile, the surface layer is dark brown fine sand about 10 inches thick. The subsoil to a depth of about 44 inches is yellowish brown, loose fine sand. Below this to a depth of 80 inches is yellowish brown, loose sand that has bands of dark yellowish brown, very friable loamy sand. The bands are individually 0.5 inch to 2.0 inches thick. They total about 4 inches in thickness within a depth of 60 inches. In some places the soil does not have these bands. In other places the total thickness of the bands is more than 6 inches. In some areas fine gravel is below a depth of 40 inches. In other areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are some small areas of the moderately well drained Brems soils in the lower landscape positions. These soils make up about 3 to 5 percent of the unit.

Available water capacity is low in the Chelsea soil. Permeability is rapid. Surface runoff is slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and a few are wooded.

This soil is poorly suited to corn, soybeans, and small grain. Droughtiness and soil blowing are the main management concerns. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control soil blowing, increase or maintain the organic matter content, and conserve moisture.

This soil is fairly well suited to grasses, such as bromegrass, and deep-rooted legumes, such as alfalfa, for hay or pasture. Shallow-rooted legumes, such as clover, are not well suited because of the low available water capacity. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality is the main management concern. Seedlings should be planted as early as possible in the spring. Also, special planting stock and overstocking are needed. Some replanting may be necessary. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

This soil is suitable as a site for dwellings and for local roads and streets. It is severely limited as a site for septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Providing loamy fill material improves the filtering capacity.

The land capability classification is IVs. The woodland ordination symbol is 3S.

Co—Cohoctah fine sandy loam, occasionally flooded. This nearly level or depressional, deep, poorly drained or very poorly drained soil is on flood plains. Individual areas are irregular in shape and are 10 to 500 acres in size. The dominant size is about 75 acres.

In a typical profile, the surface layer is black fine sandy loam about 11 inches thick. The subsurface layer also is black fine sandy loam. It is about 10 inches thick. The underlying material to a depth of 60 inches is stratified gray, very dark gray, and grayish brown, mottled loam, silt loam, and sand. It has thin lenses of sandy loam. In some small areas the surface layer is mucky. In places layers of clay loam or sandy clay loam are in the underlying material. In areas along the Tippecanoe River, the soil is more frequently flooded. In some areas the surface layer is lighter colored.

Included with this soil in mapping are some small areas of the somewhat poorly drained Algansee soils on the slightly higher parts of the landscape. These soils make up about 3 to 5 percent of the unit.

Available water capacity is high in the Cohoctah soil. Permeability is moderately rapid. Surface runoff is very slow or ponded. The water table is within a depth of 1 foot during winter and spring. The organic matter content is moderate in the surface layer.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and a few are wooded.

If drained and protected from flooding, this soil is well suited to corn, soybeans, and small grain and can be used for row crops in most years. Most areas are drained by subsurface drains and open ditches, which greatly reduce the hazard of flooding. Unless the surface is protected, soil blowing is a hazard. It can be controlled by a system of conservation tillage that leaves all or part of the crop residue on the surface.

This soil is well suited to grasses and shallow-rooted legumes for hay or pasture. It is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. A drainage system and protection from flooding are needed. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The trees are usually harvested only during extremely dry periods or when the ground is frozen. The species that can withstand the wetness should be favored in the stands. Because of seedling mortality, special planting stock and overstocking are needed. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling. Thinning or harvest methods that do not isolate the remaining trees or leave them too widely spaced reduce the windthrow hazard.

Because of wetness and flooding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of flooding, wetness, and frost action. Overcoming the flooding hazard is difficult because the floodwater is overflow from rising streams. Building the roads on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to prevent the damage caused by flooding, wetness, and frost action.

The land capability classification is IIw. The woodland ordination symbol is 3W.

CrA—Crosier loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on till plains. Individual areas are irregular in shape and are 3 to 300 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark grayish brown loam about 9 inches thick. The subsurface layer is grayish brown loam about 3 inches thick. The subsoil is about 27 inches thick. The upper part is grayish brown, mottled, firm clay loam; the next part is dark brown, mottled, firm clay loam; and the lower part is grayish brown, mottled, firm loam. The underlying material to a depth of 60 inches is brown fine sandy loam. In places the depth to the underlying material is more than 40 inches. In a few areas the upper part of the soil or the underlying material has more sand. In some areas the soil has more clay throughout. In other areas the slope is more than 2 percent.

Included with this soil in mapping are some small areas of the poorly drained Barry soils in slight depressions and along drainageways. Also included are some small areas of the well drained Riddles and Wawasee soils on the slightly higher parts of the landscape. Included soils make up about 3 to 10 percent of the unit.

Available water capacity is high in the Crosier soil. Permeability is moderately slow. Surface runoff is slow. The water table is at a depth of 1 to 3 feet during winter and spring. The organic matter content is moderate in the surface layer.

Most areas of this soil are drained by subsurface drains and are used for cultivated crops. A few areas are used for hay or pasture, and a few are wooded.

This soil is well suited to corn, soybeans, and small grain. If drained, it can be used for row crops in most years. The wetness is the main limitation. Because of puddling, the soil should not be worked when wet. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as clover and alfalfa, for

hay or pasture. It is less well suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. A drainage system is necessary. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. The seasonal wetness can slightly delay harvesting or planting. The species that can withstand wet conditions should be favored in the stands. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. It is better suited to dwellings without basements than to dwellings with basements. An adequate drainage system around footings is needed to lower the water table. Water moves slowly to drainage systems because of the restricted permeability.

This soil is severely limited as a site for local roads and streets because of frost action and low strength. Building the roads and streets on raised, well compacted fill material and constructing roadside ditches reduce the potential for frost action. Strengthening the base material with sand and gravel or resurfacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

Because of the wetness and the restricted permeability, this soil is severely limited as a site for septic tank absorption fields. Filling or mounding with suitable material improves the capacity of the field to absorb effluent. A drainage system around the outer edges of the absorption field helps to remove excess water.

The land capability classification is IIw. The woodland ordination symbol is 4A.

Ed—Edwards muck, drained. This nearly level or depressional, deep, very poorly drained soil is in depressions on outwash plains, till plains, and moraines. It is frequently ponded by runoff from the higher lying adjacent areas. Individual areas are irregular in shape and are 3 to 35 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is black muck about 11 inches thick. Below this is very dark gray and black muck about 22 inches thick. The underlying material to a depth of 60 inches is gray marl. In some small areas the muck is more than 51 inches thick. In places coprogenous earth or sand or other mineral material underlies the organic material.

Included with this soil in mapping are some small areas of Edwards muck that have not been drained. Also included, on the lower, more depressional parts of the landscape, are some small areas of soils that have less than 16 inches of muck. Included soils make up about 3 to 10 percent of the unit.

Available water capacity is very high in the Edwards soil. Permeability is moderately slow to moderately rapid in the organic material and varies in the marl. Surface runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The surface layer is very strongly acid. The organic matter content is very high in the surface layer. This layer is friable, and tilth is good.

Most areas of this soil are used for cultivated crops. Some are pastured. A few are wooded.

Even if drained, this soil is poorly suited to corn and soybeans. Nearly all areas are at least partly drained. Wetness and soil blowing are the major management concerns. Row crops can be grown in most years, but soybeans cannot be easily grown or harvested because of weeds and lodging. The soil oxidizes and subsides when exposed to air after the water table is lowered. A controlled drainage system in which the water table is lowered during periods of planting, crop growth, and harvest and is raised during other periods is needed. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control soil blowing.

If drained, this soil is fairly well suited to grasses for hay or pasture. The major concern in managing pasture is overgrazing, which reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. Undrained areas support water-tolerant trees and shrubs. The water table near or above the surface is the main limitation. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Overcoming these limitations and hazards is difficult. The trees should be harvested when the ground is frozen.

Because of ponding and low strength, this soil is generally unsuitable as a site for dwellings. Because of the ponding and the restricted permeability, it is generally unsuitable as a site for septic tank absorption fields. It is severely limited as a site for local roads because of ponding, frost action, and low strength. Replacing the organic material with suitable base material improves the ability of the roads to support vehicular traffic. Building the roads on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to remove excess water and thus help to prevent the damage caused by ponding and frost action. If adequate outlets are not available for ditches, pumps are needed.

The land capability classification is IVw. The woodland ordination symbol is 2W.

Gf—Gilford fine sandy loam. This nearly level or depressional, deep, very poorly drained soil is on broad outwash plains and lake plains. It is frequently ponded by runoff from higher lying adjacent areas (fig. 2). Individual areas are irregular in shape and are 15 to 260 acres in size. The dominant size is about 170 acres.

In a typical profile, the surface layer is black fine sandy loam about 10 inches thick. The subsoil is about 19 inches thick. The upper part is dark grayish brown, mottled, firm sandy clay loam; the next part is grayish brown, mottled, friable sandy loam; and the lower part is grayish brown, very friable loamy sand. The underlying material to a depth of 60 inches is light brownish gray coarse sand. In some areas the surface layer and subsoil have less clay. In other areas the organic matter content irregularly decreases with increasing depth. In places the soil has more clay in the upper part or in the underlying material.

Included with this soil in mapping are some small areas of the somewhat poorly drained Brady and moderately well drained Branch soils on the slightly higher parts of the landscape. Included soils make up about 3 to 10 percent of the unit.

Available water capacity is low in the Gilford soil. Permeability is moderately rapid in the upper part of the soil and rapid in the lower part. Surface runoff is very slow or ponded. The water table is near or above the surface in winter and early in spring. The organic matter content is moderate in the surface layer. This layer is friable, and tilth is good.

Most areas of this soil have been drained by subsurface drains and open ditches and are used for cultivated crops. A few areas are used as pasture or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. The wetness is the main limitation. Row crops can be grown during most years in areas that are adequately drained. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay or pasture. It is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. A drainage system is necessary. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The trees

Figure 2.—Ponding in an area of Gilford fine sandy loam.

are usually harvested only during extremely dry periods or when the ground is frozen. The species that can withstand the wetness should be favored in the stands. Because of seedling mortality, special planting stock and overstocking are needed. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them too widely spaced reduce the windthrow hazard.

Because of ponding, this soil is generally unsuitable as a site for dwellings. Because of the ponding and a poor filtering capacity, it is generally unsuitable as a site for septic tank absorption fields. It is severely limited as a site for local roads because of ponding and frost action. Building the roads on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIw. The woodland ordination symbol is 4W.

Gh—Gilford fine sandy loam, loamy substratum. This nearly level or depressional, deep, very poorly drained soil is in depressions, swales, and narrow drainageways on lake plains and outwash plains. It is frequently ponded by runoff from the higher lying adjacent areas. Individual areas are generally oval or fingerlike. They are 3 to 184 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is black fine sandy loam about 9 inches thick. The subsurface layer is very dark brown, mottled fine sandy loam about 4 inches thick. The subsoil is about 38 inches thick. The upper part is dark brown, mottled, loose loamy sand; the next part is pale brown, loose sand; and the lower part is grayish brown, mottled, friable fine sandy loam and sandy loam. The upper part of the underlying material is light brownish gray, mottled fine sandy loam and loam. The lower part to a depth of 60 inches is brown gravelly coarse sandy loam. In places the underlying material has more sand.

Included with this soil in mapping are some small areas of the well drained Metea soils on the higher parts of the landscape and the somewhat poorly drained Markton soils on the slightly higher parts. Also included, on the lower parts of the landscape, are some small areas of soils that stay wet for long periods and have a mucky loam surface layer. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is moderate in the Gilford soil. Permeability is moderately rapid in the upper part of the soil and moderately slow in the underlying material. Surface runoff is very slow or ponded. The water table is near or above the surface in winter and early in spring. The organic matter content is moderate in the surface layer. This layer can be easily tilled after the water table drops to a sufficient depth below the surface.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Most areas are drained by subsurface drains, open ditches, or combination of these. A system of conservation tillage that leaves all or part of the crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. It is less well suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. A drainage system is necessary. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and reduces plant density and plant hardiness. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help to maintain good tilth and plant density.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The trees are usually harvested only during extremely dry periods or when the ground is frozen. The species that can withstand the wetness should be favored in the stands. Because of seedling mortality, special planting stock and overstocking are needed. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them too widely spaced reduce the windthrow hazard.

Because of ponding, this soil is generally unsuitable as a site for dwellings. Because of the ponding and the restricted permeability, it is generally unsuitable as a site for septic tank absorption fields. It is severely limited as a site for local roads because of ponding and frost action. Building the roads on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIw. The woodland ordination symbol is 4W.

Hh—Histosols-Aquolls complex, ponded. These nearly level and depressional, deep, very poorly drained soils are in marshy areas on lake plains, outwash plains, till plains, and moraines. They are covered by shallow water most or all of the year. Individual areas range from 3 to 100 acres in size. They are 65 to 75 percent Histosols and 25 to 35 percent Aquolls. The organic Histosols and mineral Aquolls occur as areas so intricately mixed or so small that mapping them separately is not practical.

The upper 16 to 60 inches or more of the Histosols is black, slightly decomposed or highly decomposed muck.

Below this is sand, coprogenous earth, loamy material, or marl. In places a thin layer of loamy material has been deposited on the muck.

The surface layer of the Aquolls is black loamy material or mucky loam about 8 to 16 inches thick. The underlying material is sand, loamy sand, sandy loam, loam, sandy clay loam, or clay loam. In places the surface layer is black muck less than 16 inches thick.

Included with these soils in mapping are small areas of deep ponded water. These areas support no vegetation. They make up about 7 to 10 percent of the unit.

Available water capacity is moderate to very high in the Histosols and Aquolls. Permeability is moderately rapid to moderately slow in the upper part of the soils and moderate to slow in the lower part. Surface runoff is ponded. The organic matter content is moderate to very high in the surface layer.

These soils support small shrubs and wetland vegetation, such as wild blueberries, poison sumac, cattails, reeds, and marsh grasses. Most areas are used as wildlife habitat. Some are nursery areas for numerous aquatic animal species. Sites adjacent to streams are spawning areas for fish. Ducks, geese, and other birds use the habitat for nesting, feeding, and cover. Some fur-bearing animals also use the habitat for feeding and cover. Some areas can be used for grazing if the ponded water drops below the surface during dry periods.

Because of the ponding and the moderately slow permeability, these soils are generally unsuitable as sites for buildings and sanitary facilities. Overcoming the hazard of ponding is extremely difficult because the soils are on the lowest part of the landscape and receive water from all adjacent slopes.

The land capability classification is VIIIw. No woodland ordination symbol is assigned.

Hk—Homer fine sandy loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on outwash plains. Individual areas are irregular in shape and are 3 to 100 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is brown fine sandy loam about 8 inches thick. The subsoil is about 19 inches thick. The upper part is dark brown and dark grayish brown, mottled, firm sandy clay loam and gravelly sandy clay loam, and the lower part is dark brown, mottled, friable gravelly coarse sandy loam. The underlying material to a depth of 60 inches is brown gravelly loamy coarse sand. In some places the subsoil has less clay. In other places the upper part of the soil has no mottles. In some areas the underlying material has more clay. In other areas the depth to the underlying material is less than 24 or more than 40 inches. In places the slope is more than 2 percent.

Included with this soil in mapping are some small areas of the well drained Kosciusko soils on the slightly higher parts of the landscape. Also included are some small areas of the very poorly drained Sebewa soils in slight depressions and along some drainageways. Included soils make up about 2 to 10 percent of the unit.

Available water capacity is moderate in the Homer soil. Permeability is moderate in the upper part of the soil and very rapid in the underlying material. Surface runoff is slow. The water table is at a depth of 1 to 3 feet during winter and spring. The organic matter content is moderate in the surface layer.

Most areas of this soil are used for cultivated crops. A few are used for hay or pasture, and a few are wooded.

This soil is well suited to corn, soybeans, and small grain. If drained, it can be used for row crops in most years. The wetness is the main limitation. A system of conservation tillage that leaves all or part of the crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A drainage system is needed. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition is the main management concern. The seasonal wetness can slightly delay harvesting or planting. The species that can withstand wet conditions should be favored in the stands. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. It is better suited to dwellings without basements than to dwellings with basements. Subsurface drains help to lower the water table.

This soil is severely limited as a site for local roads and streets because of frost action and low strength. Building the roads and streets on raised, well compacted fill material and constructing roadside ditches reduce the potential for frost action. Strengthening the base material with sand and gravel or resurfacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

Because of the wetness and a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. A mound system helps to overcome the wetness.

The land capability classification is IIw. The woodland ordination symbol is 4A.

Hm—Houghton muck, drained. This nearly level or depressional, deep, very poorly drained soil is in bogs on lake plains, outwash plains, till plains, and moraines. It is frequently ponded by runoff from the higher lying adjacent areas. Individual areas are generally circular or elongated and are 5 to 80 acres in size.

In a typical profile, the surface layer is black muck about 9 inches thick. Below this to a depth of about 80 inches is black, very dark brown, and dark brown, friable muck. In some places the soil is mucky peat throughout. In other places the slope is more than 2 percent. In a few areas the soil is underlain by sand, marl, coprogenous earth, or loamy material.

Included with this soil in mapping are some small areas of the very poorly drained Wallkill soils in depressions. These soils are more loamy than the Houghton soil. Also included are a few areas of undrained Houghton soils. Included soils make up about 3 to 10 percent of the unit.

Available water capacity is very high in the Houghton soil. Permeability is moderately slow to moderately rapid. Surface runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is very high in the surface layer. This layer is friable, and tilth is good.

Most areas of this soil are drained and are used for cultivated crops. Some are pastured.

This soil is fairly well suited to corn and soybeans (fig. 3). Wetness, ponding, and soil blowing are the major management concerns. Row crops can be grown during most years in adequately drained areas. Soybeans cannot be easily grown or harvested, however, because of weeds and lodging. The soil oxidizes and subsides when exposed to air after the water table is lowered. A controlled drainage system in which the water table is lowered during periods of planting, crop growth, and harvest and is raised during other periods is needed. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control soil blowing.

This soil is well suited to grasses for hay or pasture. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. The equipment limitation, plant competition, seedling mortality, and the windthrow hazard are management concerns. Overcoming these hazards and limitations is difficult. The soil is very unstable, and low strength is a limitation. The trees should be harvested only when the ground is frozen.

Because of ponding and low strength, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of ponding, frost action, and low strength. Replacing the organic material with suitable base material improves the ability of the roads to support vehicular traffic. Building the roads on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to remove excess water and thus help to prevent the damage caused by ponding and frost action. If adequate outlets are not available for ditches, pumps are needed.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

Ho—Houghton muck, undrained. This nearly level or depressional, deep, very poorly drained soil is in bogs on lake plains, outwash plains, till plains, and moraines. It is frequently ponded by runoff from the higher lying adjacent areas. Individual areas are generally circular or elongated and are 3 to 180 acres in size.

In a typical profile, the surface layer is very dark brown muck about 10 inches thick. Below this to a depth of about 60 inches is very dark brown, dark brown, and very dark grayish brown, friable muck. In some areas the soil is mucky peat throughout. In a few areas the slope is more than 2 percent. In a few places the soil is underlain by sand, marl, coprogenous earth, or loamy material.

Included with this soil in mapping are some small areas of the very poorly drained Wallkill soils in depressions. These soils are more loamy than the Houghton soil. They make up about 5 to 10 percent of the unit.

Available water capacity is very high in the Houghton soil. Permeability is moderately slow to moderately rapid. Surface runoff is ponded. The water table is near or above the surface during most of the year. The surface layer generally is medium acid. The surface is a mat of decaying plants. The organic matter content is very high in the surface layer.

Most areas are used as wildlife habitat. Many are nursery areas for numerous aquatic animal species. Ducks, geese, and other birds use the habitat for nesting, feeding, and cover.

Because of ponding and low strength, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of ponding, frost action, and low strength. Replacing the organic material with suitable base material improves the ability of the roads to support vehicular traffic. Building the roads on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to remove excess water and thus help to prevent the damage caused by ponding and frost action. If adequate outlets are not available for ditches, pumps are needed.

The land capability classification is Vw. The woodland ordination symbol is 2W.

KoA—Kosciusko-Ormas complex, 0 to 2 percent slopes. These nearly level, deep, well drained soils are on outwash plains and terraces. Individual areas are 3 to

Figure 3.—Soybeans in an area of Houghton muck, drained, where ponding is controlled.

300 acres in size. They are 50 to 65 percent Kosciusko soil and 25 to 35 percent Ormas soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Kosciusko soil has a surface layer of very dark grayish brown fine sandy loam about 9 inches thick. The subsurface layer is brown loamy sand about 5 inches thick. The subsoil is about 17 inches thick. It is dark brown. The upper part is firm sandy clay loam, the next part is friable sandy loam, and the lower part is firm gravelly sandy clay loam. The underlying material to a depth of 60 inches is pale brown very gravelly coarse sand. In some places the depth to the underlying material is less than 24 or more than 40 inches. In other places the surface layer is loamy sand. In some areas the slope is more than 2 percent.

Typically, the Ormas soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsurface layer is about 20 inches of yellowish brown, very friable loamy sand, loose sand, and very friable gravelly loamy sand. The subsoil is about 19 inches thick. It is yellowish brown. It is firm gravelly sandy clay loam in the upper part and friable gravelly coarse sandy loam in the lower part. The underlying material to a depth of 60 inches is yellowish brown gravelly coarse sand. In some places

the depth to the underlying material is less than 40 inches. In other places the subsoil tongues into the underlying material to varying depths. In a few areas the soil has more sand and less clay throughout. In some areas the slope is more than 2 percent.

Included with these soils in mapping are a few small areas of the somewhat poorly drained Homer soils on the slightly lower parts of the landscape and a few areas of the very poorly drained Sebewa soils in depressions and swales. Included soils make up about 4 to 10 percent of the unit.

Available water capacity is low in the Kosciusko and Ormas soils. Permeability is moderate in the subsoil and very rapid in the underlying material. Surface runoff is slow. The organic matter content is low in the surface layer of both soils. The surface layer of the Kosciusko soil is friable, and that of the Ormas soil is very friable. The surface layer of both soils can be easily tilled.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

These soils are fairly well suited to corn, soybeans, and small grain. They are suitable for a cropping sequence dominated by row crops. Droughtiness and soil blowing are the major management concerns. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing, increases or maintains the organic matter content, and conserves moisture.

These soils are well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during dry periods help to maintain good tilth and plant density.

These soils are well suited to trees. Plant competition and seedling mortality are the main management concerns. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The Kosciusko soil is moderately limited as a site for dwellings without basements because of the shrink-swell potential. Properly designing foundations and footings and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The Ormas soil is suitable as a site for dwellings without basements. Both soils are suitable as sites for dwellings with basements.

These soils are moderately limited as sites for local roads and streets because of frost action in both soils and shrinking and swelling in the Kosciusko soil. Strengthening the base with coarser textured material improves the ability of the roads and streets to support vehicular traffic and helps to prevent the damage caused by frost action and by shrinking and swelling.

Because of a poor filtering capacity, these soils are severely limited as sites for septic tank absorption fields. They readily absorb but do not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Installing the absorption field in a mound of loamy fill material improves the filtering capacity.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

KoB—Kosciusko-Ormas complex, 2 to 6 percent slopes. These gently sloping, deep, well drained soils are on outwash plains and terraces. Individual areas are 3 to 67 acres in size. They are 50 to 65 percent Kosciusko soil and 25 to 35 percent Ormas soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Kosciusko soil has a surface layer of very dark grayish brown fine sandy loam about 10 inches thick. The subsoil is about 24 inches thick. The upper part is brown, very friable loamy sand, and the lower part is dark brown, firm sandy clay loam. The underlying material to a depth of 60 inches is brown gravelly coarse sand. In some places the depth to the underlying material is less than 24 or more than 40 inches. In other places the surface layer is loamy sand. In a few areas erosion has removed most of the topsoil. In some areas the slope is less than 2 or more than 6 percent.

Typically, the Ormas soil has a surface layer of dark brown loamy sand about 10 inches thick. The subsurface layer is about 27 inches of yellowish brown, loose sand and fine sand. The subsoil is about 19 inches thick. It is dark brown. The upper part is friable sandy loam, and the lower part is firm sandy clay loam. The underlying material to a depth of 60 inches is dark brown gravelly sand. In some places the depth to the underlying material is less than 40 inches. In other places the subsoil tongues into the underlying material to varying depths. In a few areas the soil has more sand and less clay throughout. In some areas the slope is less than 2 or more than 6 percent.

Included with these soils in mapping are a few small areas of the somewhat poorly drained Homer soils on the slightly lower parts of the landscape and a few areas of the very poorly drained Sebewa soils in depressions at the base of the slopes. Included soils make up about 3 to 10 percent of the unit.

Available water capacity is low in the Kosciusko and Ormas soils. Permeability is moderate in the subsoil and very rapid in the underlying material. Surface runoff is medium on the Kosciusko soil and slow on the Ormas soil. The organic matter content is low in the surface layer of both soils. The surface layer of the Kosciusko soil is friable, and that of the Ormas soil is very friable. The surface layer of both soils can be easily tilled.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

These soils are fairly well suited to corn, soybeans, and small grain. Droughtiness and the hazards of water

erosion and soil blowing are the major management concerns. Measures that help to control erosion and surface runoff are needed. A crop rotation that includes grasses and legumes, terraces, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and improves or maintains tilth and the organic matter content.

These soils are well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to maintain good tilth and plant density.

These soils are well suited to trees. Plant competition and seedling mortality are the main management concerns. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The Kosciusko soil is moderately limited as a site for dwellings without basements because of the shrink-swell potential. Properly designing foundations and footings and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The Ormas soil is suitable as a site for dwellings without basements. Both soils are suitable as sites for dwellings with basements.

These soils are moderately limited as sites for local roads and streets because of frost action in both soils and shrinking and swelling in the Kosciusko soil. Strengthening the base with coarser textured material improves the ability of the roads and streets to support vehicular traffic and helps to prevent the damage caused by frost action and by shrinking and swelling.

Because of a poor filtering capacity, these soils are severely limited as sites for septic tank absorption fields. They readily absorb but do not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Installing the absorption field in a mound of loamy fill material improves the filtering capacity.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

KoC—Kosciusko-Ormas complex, 6 to 12 percent slopes. These moderately sloping, deep, well drained soils are on outwash plains and terraces. Individual areas are 3 to 69 acres in size. They are 50 to 65 percent Kosciusko soil and 25 to 35 percent Ormas soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Kosciusko soil has a surface layer of very dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 22 inches thick. The upper part is brown, very friable loamy sand, and the lower part is dark brown, firm sandy clay loam. The underlying material to a depth of 60 inches is brown very gravelly coarse sand. In a few places the depth to the underlying material is less than 24 or more than 40 inches. In other places the surface layer is loamy sand. In a few areas erosion has removed most of the topsoil. In some areas the slope is less than 6 or more than 12 percent.

Typically, the Ormas soil has a surface layer of dark brown loamy sand about 10 inches thick. The subsurface layer is yellowish brown, loose sand about 20 inches thick. The subsoil is dark brown, friable sandy loam about 19 inches thick. The underlying material to a depth of 60 inches is dark brown gravelly coarse sand. In some places the depth to the underlying material is less than 40 inches. In other places the subsoil tongues into the underlying material to varying depths. In a few areas the soil has more sand and less clay throughout. In some areas the slope is less than 6 or more than 12 percent.

Included with these soils in mapping are a few small areas of the somewhat poorly drained, nearly level Homer soils on the lower parts of the landscape and a few areas of the very poorly drained Sebewa soils in depressions near the base of the slopes. Included soils make up about 3 to 10 percent of the unit.

Available water capacity is low in the Kosciusko and Ormas soils. Permeability is moderate in the subsoil and very rapid in the underlying material. Surface runoff is medium. The organic matter content is low in the surface layer of both soils. The surface layer of the Kosciusko soil is friable, and that of the Ormas soil is very friable. The surface layer of both soils can be easily tilled.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

These soils are fairly well suited to corn, soybeans, and small grain. Droughtiness and the hazards of water erosion and soil blowing are the major management concerns. Measures that help to control erosion and surface runoff are needed. A crop rotation dominated by grasses and legumes, terraces, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and improves or maintains tilth and the organic matter content.

These soils are well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to maintain good tilth and plant density.

These soils are well suited to trees. Plant competition and seedling mortality are the main management concerns. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope of both soils is a moderate limitation on sites for dwellings. Also, the shrink-swell potential of the Kosciusko soil is a moderate limitation on sites for dwellings without basements. Properly designing foundations and footings and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Land shaping generally is needed to level the site. Developing random lots, retaining as much of the existing vegetation as possible, establishing housing developments and roads on the contour, and establishing diversions that intercept runoff between lots help to control erosion. Stockpiling topsoil for use as the final layer and reseeding grasses as soon as possible also help to control erosion.

These soils are moderately limited as sites for local roads and streets because of shrinking and swelling in the Kosciusko soil and the slope and potential for frost action in both soils. Strengthening the base with coarser textured material improves the ability of the roads and streets to support vehicular traffic and helps to prevent the damage caused by frost action and by shrinking and swelling. Cutting and filling are needed, and the roads should be built on the contour if possible.

Because of a poor filtering capacity, these soils are severely limited as sites for septic tank absorption fields. They readily absorb but do not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Installing the absorption field in a mound of loamy fill material improves the filtering capacity.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

MaA—Markton loamy sand, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is in slightly convex areas on lake plains and till plains. Individual areas are irregular in shape and are 3 to 94 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is very dark grayish brown loamy sand about 10 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, loose fine sand; the next part is dark brown, mottled, friable loamy sand and sandy loam; and the lower part is grayish brown, mottled, friable fine sandy loam. The underlying material to a depth of 60 inches is brown, mottled loam. In some areas the surface layer is fine sandy loam. In places the slope is more than 2 percent.

Included with this soil in mapping are a few small areas of the excessively drained Chelsea and well drained Metea and Wawasee soils on the higher slopes and a few areas of the very poorly drained Gilford soils in depressions. Included soils make up 5 to 10 percent of the unit.

Available water capacity is moderate in the Markton soil. Permeability is rapid in the upper part of the soil and moderate in the lower part. Surface runoff is slow. The water table is at a depth of 1 to 3 feet during winter and spring. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are drained and are used for cultivated crops. Some are used for hay or pasture, and a few are wooded.

This soil is fairly well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is suited to intensive row cropping. The wetness is the main limitation. Excess water can be removed by open ditches or subsurface drains. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control soil blowing, increase or maintain the organic matter content, and conserve moisture.

This soil is well suited to grasses, such as bromegrass, and shallow-rooted legumes, such as clover, for hay or pasture. It is not well suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table and the shallowness to calcareous till or lacustrine material. A drainage system is necessary. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition and seedling mortality are the main management concerns. The seasonal wetness can slightly delay harvesting or planting. The species that can tolerate wet conditions should be favored in the stands. Because of seedling mortality, seedlings should be planted as early as possible in the spring. Also, special planting stock and overstocking are needed. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. It is better suited to dwellings without basements than to dwellings with basements. An adequate drainage system is needed to lower the water table. The soil is severely limited as a site for local roads and streets because of frost action. Building the roads and streets on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to prevent the damage caused by frost action.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. The water table can be lowered by an adequate perimeter subsurface drainage system.

The land capability classification is IIIw. The woodland ordination symbol is 4S.

MeA—Metea loamy sand, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on moraines and till plains. Individual areas are irregular in shape and

are 3 to 57 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is brown loamy sand about 10 inches thick. The subsurface layer is dark yellowish brown, very friable loamy sand about 30 inches thick. The subsoil is about 15 inches thick. The upper part is yellowish brown, friable fine sandy loam, and the lower part is dark yellowish brown and yellowish brown, firm loam. The underlying material to a depth of 60 inches is yellowish brown loam. In places the soil has more sand throughout. In a few places the surface layer has less sand. In some areas the slope is more than 2 percent.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Markton soils on the lower parts of the landscape. Also included are a few areas of soils that are more slowly permeable than the Metea soil. Included soils make up about 5 to 12 percent of the unit.

Available water capacity is moderate in the Metea soil. Permeability is rapid in the sandy upper part of the soil and moderate in the lower part. Surface runoff is slow. The organic matter content is low in the surface layer. This layer is friable, and tilth is good.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. It is suitable for a cropping sequence dominated by row crops. The moderate available water capacity and soil blowing are the major management concerns. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface increase or maintain the organic matter content, conserve moisture, and help to control soil blowing.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants helps to control soil blowing. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during dry periods help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality and plant competition are the main management concerns. Because of seedling mortality, seedlings should be planted as early as possible in the spring. Also, special planting stock and overstocking are needed. Some replanting may be necessary. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

This soil is suitable as a site for dwellings. It is moderately limited as a site for local roads and streets because of frost action. Strengthening the base material with sand and gravel helps to prevent the damage caused by frost action. The soil is severely limited as a site for septic tank absorption fields because it has a poor filtering capacity. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. This problem can be minimized by filling or mounding with better suited loamy material.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

MeB—Metea loamy sand, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on moraines and till plains. Individual areas are irregular in shape and are 3 to 235 acres in size. The dominant size is about 12 acres.

In a typical profile, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer is yellowish brown, very friable loamy sand about 15 inches thick. The subsoil is about 15 inches thick. It is dark yellowish brown. The upper part is friable fine sandy loam, and the lower part is firm loam. The underlying material to a depth of 60 inches is pale brown and yellowish brown loam. In places the soil has more sand throughout. In a few places the surface layer has less sand. In some areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are a few small areas of the somewhat poorly drained, nearly level Markton soils on the lower parts of the landscape. Also included are a few areas of soils that are more slowly permeable than the Metea soil. Included soils make up about 5 to 12 percent of the unit.

Available water capacity is moderate in the Metea soil. Permeability is rapid in the sandy upper part of the soil and moderate in the lower part. Surface runoff is slow. The organic matter content is low in the surface layer. This layer is friable, and tilth is good.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Measures that help to control erosion and surface runoff are needed. A crop rotation that includes grasses and legumes, terraces, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. Soil blowing is a hazard, and droughtiness is a problem during dry periods. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface increase or maintain the organic matter content, conserve moisture, and help to control soil blowing.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants helps to control soil blowing and water erosion. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality and plant competition are the main management concerns.

Because of seedling mortality, seedlings should be planted as early as possible in the spring. Also, special planting stock and overstocking are needed. Some replanting may be necessary. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

This soil is suitable as a site for dwellings. It is moderately limited as a site for local roads and streets because of frost action. Strengthening the base material with sand and gravel helps to prevent the damage caused by frost action. The soil is severely limited as a site for septic tank absorption fields because it has a poor filtering capacity. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. This problem can be minimized by filling or mounding with better suited loamy material.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

MeC—Metea loamy sand, 6 to 12 percent slopes. This moderately sloping, deep, well drained soil is on moraines and till plains. Individual areas are irregular in shape and are 3 to 36 acres in size. The dominant size is about 12 acres.

In a typical profile, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer is yellowish brown, loose fine sand about 16 inches thick. The subsoil is dark yellowish brown, firm sandy loam about 15 inches thick. The underlying material to a depth of 60 inches is brown loam. In places the soil has more sand throughout. In a few places the surface layer has less sand. In some areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are a few small areas of the somewhat poorly drained, nearly level Markton soils. Also included are a few areas of soils that are more slowly permeable than the Metea soil. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is moderate in the Metea soil. Permeability is rapid in the sandy upper part of the soil and moderate in the lower part. Surface runoff is medium. The organic matter content is low in the surface layer. This layer is friable, and tilth is good.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and some are wooded.

This soil is fairly well suited to corn, soybeans, and small grain. Measures that help to control water erosion, soil blowing, and surface runoff are needed. A crop rotation dominated by grasses and legumes, terraces, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface increase or maintain the organic matter content, conserve moisture, and help to control soil blowing.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants helps to control soil blowing and water erosion. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality and plant competition are the main management concerns. Because of seedling mortality, seedlings should be planted as early as possible in the spring. Also, special planting stock and overstocking are needed. Some replanting may be necessary. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. Land shaping generally is needed. Developing random lots, retaining as much of the existing vegetation as possible, establishing housing developments and roads on the contour, and establishing diversions that intercept runoff between lots help to control erosion. Stockpiling topsoil for use as the final layer and reseeding grasses as soon as possible also help to control erosion.

Because of the slope and frost action, this soil is moderately limited as a site for local roads and streets. Providing coarser textured base material helps to prevent the damage caused by frost action. Cutting and filling are needed, and the roads should be built on the contour if possible.

This soil is severely limited as a site for septic tank absorption fields because it has a poor filtering capacity. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. This problem can be minimized by filling or mounding with better suited loamy material.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

MrB2—Morley loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained or moderately well drained soil is on uplands. Individual areas are irregular in shape and are 3 to 40 acres in size.

In a typical profile, the surface layer is dark grayish brown loam about 9 inches thick. It is mixed with lumps and specks of dark yellowish brown clay loam. The subsoil is about 30 inches thick. The upper part is dark yellowish brown, firm clay; the next part is yellowish brown, firm clay loam; and the lower part is brown, firm clay loam. The underlying material to a depth of 60 inches is brown clay loam. In places the subsoil is thicker. In a few places the surface layer has been mixed

with the subsoil by plowing and is clay loam. In some areas the soil has more sand and less clay throughout and is deeper to the underlying material. In other areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are a few small areas of the somewhat poorly drained, nearly level Blount soils on the lower parts of the landscape. Also included are a few areas of the very poorly drained Pewamo soils in depressions. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is moderate in the Morley soil. Permeability is moderately slow or slow. Surface runoff is rapid. The water table is at a depth of 3 to 6 feet during spring. The organic matter content is moderate in the surface layer. This layer becomes cloddy and hard to work if tilled when the soil is too wet.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and a few are wooded.

This soil is well suited to corn, soybeans, and small grain. Measures that help to control erosion and surface runoff are needed. A crop rotation that includes grasses and legumes, terraces, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface also help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Also, the wetness is a moderate limitation on sites for dwellings with basements. Properly designing foundations and footings and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The dwellings should be constructed without basements, or foundation drains should be installed to reduce the wetness. If vegetation is removed from large areas, erosion is a hazard. It can be controlled by retaining as much of the existing vegetation as possible during construction. Stockpiling topsoil for use as the final layer and reseeding grasses as soon as possible also help to control erosion.

Because of low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with coarser textured material improves the ability of the roads and streets to support vehicular traffic.

Because of the wetness and the restricted permeability, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption field or filling or mounding with suitable material improves the capacity of the field to absorb effluent. A drainage system around the outer edges of the absorption field helps to remove excess water.

The land capability classification is IIe. The woodland ordination symbol is 4A.

MsC3—Morley clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained or moderately well drained soil is on uplands. Individual areas are irregular in shape and are 3 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is dark brown clay loam about 7 inches thick. The subsoil is dark brown, firm clay about 19 inches thick. The underlying material to a depth of 60 inches is yellowish brown clay and clay loam. In some places the depth to the underlying material is more than 45 or less than 22 inches. In other places the soil has a surface layer of loam and is moderately eroded. In a few areas it has more sand and less clay throughout. In some areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are a few small areas of the somewhat poorly drained, nearly level Blount soils on the lower part of the landscape. Also included are a few areas of the very poorly drained Pewamo soils along drainageways. Included soils make up 5 to 10 percent of the unit.

Available water capacity is moderate in the Morley soil. Permeability is moderately slow or slow. Surface runoff is rapid. The water table is at a depth of 3 to 6 feet during spring. The surface layer is slightly acid or neutral. The organic matter content is moderate in the surface layer. This layer becomes cloddy and hard to work if tilled when the soil is too wet.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and some are wooded.

This soil is poorly suited to cultivated crops. Erosion is a severe hazard if corn or soybeans are grown. Small grain can be grown in rotation with hay or pasture. A crop rotation dominated by grasses and legumes, terraces, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface also help to control erosion and improve or maintain tilth and the organic matter content.

This soil is fairly well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or

pasture. A cover of these plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. Also, the wetness is a moderate limitation on sites for dwellings with basements. Properly designing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. The dwellings should be constructed without basements, or foundation drains should be installed to reduce the wetness. The dwellings should be designed so that they conform to the natural slope of the land. Otherwise, extensive land shaping is needed. Developing random lots, retaining as much of the existing vegetation as possible, establishing housing developments and roads on the contour, and establishing diversions that intercept runoff between lots help to control erosion. Stockpiling topsoil for use as the final layer and reseeding grasses as soon as possible also help to control erosion.

Because of low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with coarser textured material improves the ability of the roads and streets to support vehicular traffic.

Because of the wetness and the restricted permeability, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption field or filling or mounding with suitable material improves the capacity of the field to absorb effluent. A drainage system around the outer edges of the absorption field helps to remove excess water.

The land capability classification is IVe. The woodland ordination symbol is 4A.

Mu—Morocco loamy sand. This nearly level, deep, somewhat poorly drained soil is on outwash plains. Individual areas are irregularly shaped or circular and are 3 to 45 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark yellowish brown loamy sand about 10 inches thick. The subsoil is brown and yellowish brown, mottled, loose sand about 28 inches thick. The underlying material to a depth of about 60 inches is brownish yellow and light yellowish brown, mottled sand. In places the surface layer is very strongly acid. In some small areas the subsoil and underlying material have strata of loamy sand and sandy loam. In some areas they are medium acid or slightly acid. In some small areas the subsoil does not have mottles in the upper part.

Included with this soil in mapping are some small areas of the moderately well drained Brems soils on the slightly higher parts of the landscape and the very poorly drained Newton soils in depressions. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is low in the Morocco soil. Permeability is rapid. Surface runoff is slow. The water table is at a depth of 1 to 2 feet during winter and spring. The surface layer is medium acid. The organic matter content is low in the surface layer. This layer is very friable, and tilth is good.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is poorly suited to corn, soybeans, and small grain. The seasonal high water table is a limitation during wet periods, and the low available water capacity is a limitation during dry periods. Crops can be damaged by drought and by overdraining. Also, soil blowing is a hazard during dry periods. If the soil is adequately drained, a cropping sequence dominated by row crops is suitable. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface increase or maintain the organic matter content, conserve moisture, and help to control soil blowing.

This soil is fairly well suited to deep-rooted legumes and drought-tolerant grasses for hay or pasture. A cover of these plants helps to control soil blowing. Shallow-rooted legumes, such as clover, are poorly suited because of the low available water capacity. Overgrazing increases the susceptibility to soil blowing and reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, and deferment of grazing during dry periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality is the main management concern. Planting seedlings as early as possible in the spring reduces the seedling mortality rate. Some replanting may be needed. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. An adequate drainage system is needed to lower the water table. The soil is moderately limited as a site for local roads and streets because of frost action and wetness. Constructing roadside ditches that lower the water table and elevating the roadbed reduce the wetness and the potential for frost action.

Because of the wetness and a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Adding suitable fill material helps to ensure that the absorption field functions properly. The water table can be lowered by an adequate subsurface drainage system.

The land capability classification is IVs. The woodland ordination symbol is 4W.

Mx—Muskego muck, drained. This nearly level or depressional, deep, very poorly drained soil is in bogs on lake plains, outwash plains, till plains, and moraines. It is frequently ponded by runoff from the higher lying adjacent areas. Individual areas are generally circular or elongated and are 5 to 30 acres in size.

In a typical profile, the surface layer is black muck about 8 inches thick. The subsurface layer is very dark brown muck about 12 inches thick. The underlying material to a depth of 60 inches is coprogenous earth. It is very dark grayish brown in the upper part, dark olive gray in the next part, and dark gray in the lower part. In some small areas the soil is underlain by marl or by sandy or loamy material. In some areas the muck is more than 51 inches thick. In a few areas sandy material underlies the coprogenous earth. In places the slope is more than 2 percent.

Included with this soil in mapping are some small areas of Muskego muck that have not been drained and some small areas of the very poorly drained, loamy Sebewa soils. Included soils make up 2 to 5 percent of the unit.

Available water capacity is very high in the Muskego soil. Permeability is moderate or moderately rapid in the upper part of the soil and slow in the underlying coprogenous earth. Surface runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The surface layer is very strongly acid. The organic matter content is very high in the surface layer. This layer is friable, and tilth is good.

Most areas of this soil are used for cultivated crops. Some are pastured.

This soil is poorly suited to corn and soybeans. Wetness, ponding, and soil blowing are the major management concerns. Row crops can be grown during most years in adequately drained areas. Soybeans cannot be easily grown or harvested, however, because of weeds and lodging. The soil oxidizes and subsides when exposed to air after the water table is lowered. A controlled drainage system in which the water table is lowered during periods of planting, crop growth, and harvest and is raised during other periods is needed. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control soil blowing.

This soil is fairly well suited to grasses for hay or pasture. A drainage system is needed. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. Undrained areas support water-tolerant trees and shrubs. The equipment limitation, plant competition, seedling mortality, and the windthrow hazard are management concerns. Overcoming these limitations and hazards is difficult because the soil is unstable. The trees should be harvested only when the ground is frozen. Harvest methods that do not isolate the remaining trees or leave them too widely spaced reduce the windthrow hazard.

Because of low strength and ponding, this soil is generally unsuitable as a site for dwellings. Because of the ponding and the restricted permeability in the coprogenous earth, it is generally unsuitable as a site for septic tank absorption fields. It is severely limited as a site for local roads because of ponding, frost action, and subsidence of the organic material. Replacing the organic material and coprogenous earth with suitable base material improves the ability of the roads to support vehicular traffic. Building the roads on raised, well compacted fill material and constructing roadside ditches that remove excess water help to prevent the damage caused by ponding and frost action. If adequate outlets are not available for ditches, pumps are needed.

The land capability classification is IVw. The woodland ordination symbol is 2W.

Ne—Newton fine sandy loam. This nearly level or depressional, deep, very poorly drained soil is on outwash plains and lake plains. It is frequently ponded by runoff from the higher lying adjacent areas. Individual areas are irregular in shape and are 3 to 120 acres in size. The dominant size is about 30 acres.

In a typical profile, the surface layer is black fine sandy loam about 10 inches thick. The subsurface layer is black loamy sand about 8 inches thick. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, mottled fine sand and sand. In a few small areas calcareous gravelly coarse sand is in the lower part of the underlying material. In some places a thin layer of muck is at the surface. In other places the surface soil and subsoil have more clay. In a few areas the organic matter content irregularly decreases with increasing depth.

Included with this soil in mapping are small areas of the moderately well drained Brems soils on slight rises and small areas of the excessively drained Plainfield soils on the higher parts of the landscape. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is low in the Newton soil. Permeability is rapid. Surface runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is moderate in the surface layer. This layer is very friable, and tilth is good.

Most areas of this soil are drained and are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is poorly suited to corn and soybeans. The wetness is the major limitation. Excessive drainage can increase the susceptibility to drought and soil blowing.

Row crops can be grown during most years in adequately drained areas. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface increase or maintain the organic matter content, conserve moisture, and help to control soil blowing.

This soil is fairly well suited to grasses and shallow-rooted legumes for hay or pasture. It is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. A drainage system is necessary. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is fairly well suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. The trees are usually harvested only during extremely dry periods or when the ground is frozen. The species that can withstand the wetness should be favored in the stands. Thinning or harvest methods that do not isolate the remaining trees or leave them too widely spaced reduce the windthrow hazard. Plant competition can be controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and is severely limited as a site for local roads. Constructing the roads on raised, well compacted fill material and constructing drainage ditches help to remove excess water. Because of the ponding and a poor filtering capacity, the soil is generally unsuitable as a site for septic tank absorption fields.

The land capability classification is IVw. The woodland ordination symbol is 4W.

OmA—Ormas loamy sand, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on outwash plains and terraces. Individual areas are irregularly shaped and are 3 to 46 acres in size. The dominant size is about 14 acres.

In a typical profile, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is dark yellowish brown and light yellowish brown, loose sand about 24 inches thick. The subsoil is about 20 inches thick. It is dark yellowish brown. The upper part is friable sandy loam, and the lower part is loose gravelly loamy sand. The underlying material to a depth of 60 inches is yellowish brown gravelly coarse sand. In some places the depth to calcareous gravelly coarse sand is more than 75 inches. In other places the lower part of the subsoil has less clay. In a few areas the lower part of the subsoil and the underlying material have more clay. In some areas the slope is more than 2 percent.

Included with this soil in mapping are some small areas of the somewhat poorly drained Brady soils on the nearly level parts of the landscape, the moderately well drained Branch soils on the slightly lower parts, and the very poorly drained Gilford soils in depressions. Included soils make up about 4 to 10 percent of the unit.

Available water capacity is low in the Ormas soil. Permeability is rapid in the surface layer and the upper part of the subsoil, moderately rapid in the lower part of the subsoil, and very rapid in the underlying material. Surface runoff is slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and a few are wooded.

This soil is fairly well suited to corn, soybeans, and small grain. Droughtiness and soil blowing are the main management concerns. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control soil blowing, increase or maintain the organic matter content, and conserve moisture.

This soil is well suited to deep-rooted grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants helps to control soil blowing. Shallow-rooted legumes, such as clover, are not well suited because of the low available water capacity. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality is the main management concern. Seedlings should be planted as early as possible in the spring. Also, special planting stock and overstocking are needed. Some replanting may be necessary. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

This soil is suitable as a site for dwellings. It is moderately limited as a site for local roads and streets because of frost action. Building the roads and streets on raised, well compacted fill material helps to prevent the damage caused by frost action. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Installing the absorption field in a mound of loamy fill material improves the filtering capacity.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

OmB—Ormas loamy sand, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on outwash plains and terraces. Individual areas are irregularly shaped and are 3 to 35 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer is about 27 inches thick. The upper part is yellowish brown, loose sand, and the lower part is brownish yellow, loose fine sand. The subsoil is about 19 inches of dark yellowish brown, friable fine sandy loam and loamy sand. The underlying material to a depth of 60 inches is yellowish brown gravelly coarse sand. In some places the depth to calcareous gravelly coarse sand is more than 75 inches. In other places the lower part of the subsoil has less clay. In a few areas the lower part of the subsoil and the underlying material have more clay. In some areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are some small areas of the somewhat poorly drained, nearly level Brady soils on the lower parts of the landscape; the moderately well drained Branch soils on the slightly lower parts; and the very poorly drained Gilford soils in depressions. Included soils make up about 3 to 10 percent of the unit.

Available water capacity is low in the Ormas soil. Permeability is rapid in the surface layer and the upper part of the subsoil, moderately rapid in the lower part of the subsoil, and very rapid in the underlying material. Surface runoff is slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and some are wooded.

This soil is fairly well suited to corn, soybeans, and small grain. Droughtiness and soil blowing are the main management concerns. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control soil blowing, increase or maintain the organic matter content, and conserve moisture.

This soil is well suited to deep-rooted grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants helps to control soil blowing. Shallow-rooted legumes, such as clover, are not well suited because of the low available water capacity. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, and timely deferment of grazing, help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality is the main management concern. Seedlings should be planted as early as possible in the spring. Also, special planting stock and overstocking are needed. Some replanting may be necessary. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

This soil is suitable as a site for dwellings. It is moderately limited as a site for local roads and streets because of frost action. Building the roads and streets on raised, well compacted fill material helps to prevent the damage caused by frost action. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Installing the absorption field in a mound of loamy fill material improves the filtering capacity.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

Pe—Pewamo clay loam. This nearly level or depressional, deep, very poorly drained soil is in depressions on till plains and moraines. It is frequently ponded by runoff from the higher lying adjacent areas. Individual areas are irregularly shaped or elongated and are 3 to 20 acres in size.

In a typical profile, the surface layer is very dark brown clay loam about 9 inches thick. The subsoil is very dark gray, grayish brown, and gray, mottled, firm clay about 27 inches thick. The underlying material to a depth of 60 inches is gray, mottled silty clay. In a few places a thin layer of overwash material from the higher lying surrounding soils covers the surface. In a few areas the soil has less clay throughout. In places the slope is more than 2 percent.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Blount soils on the slightly higher parts of the landscape and a few small areas of the moderately well drained or well drained Morley soils on the surrounding slopes. Included soils make up about 8 to 12 percent of the unit.

Available water capacity is high in the Pewamo soil. Permeability is moderate. Surface runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is moderate in the surface layer. This layer becomes cloddy and hard to work if tilled when the soil is wet. Also, a compact plowpan forms if the soil is tilled when it is wet. The plowpan can restrict root growth and lower yields.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. If drained, it can be used for row crops in most years. The wetness is the main limitation. A system of conservation tillage that leaves all or part of the crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as clover, for hay or pasture. It is less well suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. A drainage system is necessary. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing,

timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Because of seedling mortality, special planting stock and overstocking are needed. Some replanting may be necessary. The species that can withstand the wetness should be favored in the stands. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them too widely spaced reduce the windthrow hazard. The trees are usually harvested only during extremely dry periods or when the ground is frozen.

Because of ponding, this soil is generally unsuitable as a site for dwellings. Because of the ponding and the restricted permeability, it is generally unsuitable as a site for septic tank absorption fields. It is severely limited as a site for local roads because of ponding, low strength, and frost action. Building the roads on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to prevent the damage caused by ponding and frost action. Strengthening the base with better suited material improves the ability of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Pk—Pits, gravel. This map unit is in nearly level to very steep areas where the overlying soil has been removed and the underlying sand and gravel exposed at varying depths (fig. 4). The unit is on kames, outwash plains, and moraines. Individual areas are 3 to 44 acres in size.

Included with the pits in mapping are areas of Kosciusko and Ormas soils. Also included are some areas where the pits contain small bodies of water. Included areas make up about 1 percent of the unit.

The parts of the pits that are being mined support no vegetation. A sparse plant cover, mainly annual weeds and grasses, grows around the perimeter in some areas. Onsite investigation is needed to determine the suitability for specific uses.

No land capability classification or woodland ordination symbol is assigned.

PlA—Plainfield sand, 0 to 2 percent slopes. This nearly level, deep, excessively drained soil is on slightly convex outwash plains, stream terraces, and moraines. Individual areas are irregular in shape and are 3 to 160 acres in size. The dominant size is about 75 acres.

In a typical profile, the surface layer is very dark grayish brown sand about 10 inches thick. The subsoil is yellowish brown, loose sand about 14 inches thick. The underlying material to a depth of 60 inches is yellowish brown sand. In a few places the soil has a thin, banded subsoil. In some areas loamy sand or sandy loam is in the lower part of the subsoil or in the underlying material. In other areas the slope is more than 2 percent.

Included with this soil in mapping are a few small areas of the moderately well drained, nearly level Brems and somewhat poorly drained, nearly level Morocco soils on the slightly lower parts of the landscape and the very poorly drained Newton soils in depressions. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is low in the Plainfield soil. Permeability is rapid. Surface runoff is slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled.

Most areas are used for hay or pasture. Some are used for woodland or Christmas trees, and some are cultivated. This soil is generally unsuited to corn, soybeans, and small grain. Droughtiness and the hazard of soil blowing are the major management concerns.

This soil is poorly suited to deep-rooted grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants helps to control soil blowing. Shallow-rooted legumes, such as clover, are not suited because of the low available water capacity. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality is the main management concern. Seedlings should be planted as early as possible in the spring. Also, special planting stock and overstocking are needed. Some replanting may be necessary. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

This soil is suitable as a site for dwellings and for local roads and streets. It is severely limited as a site for septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Adding suitable fill material improves the filtering capacity.

The land capability classification is VIs. The woodland ordination symbol is 4S.

PlB—Plainfield sand, 2 to 6 percent slopes. This gently sloping, deep, excessively drained soil is on the convex summits, side slopes, and crests of outwash plains, stream terraces, and moraines. Individual areas are generally longer than they are wide and are 3 to 23 acres in size.

In a typical profile, the surface layer is very dark brown sand about 4 inches thick. The subsoil is dark yellowish brown, loose sand about 21 inches thick. The underlying material to a depth of 80 inches is yellowish brown sand. In a few places the soil has a thin, banded subsoil. In

Figure 4.—The wall of a gravel pit.

some areas loamy sand or sandy loam is in the lower part of the subsoil or in the underlying material. In other areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are some small areas of the moderately well drained, nearly level Brems and somewhat poorly drained, nearly level Morocco soils on the lower parts of the landscape and the very poorly drained Newton soils in depressions. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is low in the Plainfield soil. Permeability is rapid. Surface runoff is slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled.

Most areas are wooded. Some are cultivated, and some are used for hay or pasture. This soil is generally unsuited to corn, soybeans, and small grain. Droughtiness and the hazard of soil blowing are the major management concerns.

This soil is poorly suited to deep-rooted grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants helps to control soil blowing. Shallow-rooted legumes, such as clover, are not suited because of the low available water capacity. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality is the main management concern. Seedlings should be planted as early as possible in the spring. Also, special

planting stock and overstocking are needed. Some replanting may be necessary. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

This soil is suitable as a site for dwellings and for local roads and streets. It is severely limited as a site for septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Adding suitable fill material improves the filtering capacity.

The land capability classification is VIs. The woodland ordination symbol is 4S.

PIC—Plainfield sand, 6 to 12 percent slopes. This moderately sloping, deep, excessively drained soil is on outwash plains, stream terraces, and moraines. It is on the convex summits, side slopes, and crests along stream valleys. Individual areas are irregularly shaped and are 3 to 49 acres in size. The dominant size is about 9 acres.

In a typical profile, the surface layer is dark brown sand about 8 inches thick. The underlying material to a depth of 60 inches is sand. The upper part is yellowish brown, and the lower part is brownish yellow. In a few places the soil has a thin, banded subsoil. In a few areas loamy sand or sandy loam is in the lower part of the subsoil or in the underlying material. In places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are some small areas of the moderately well drained, nearly level Brems and somewhat poorly drained, nearly level Morocco soils on the lower parts of the landscape. Also included are a few areas of the very poorly drained Newton soils in depressions. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is low in the Plainfield soil. Permeability is rapid. Surface runoff is medium. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled.

Most areas are wooded. Some are used for hay or pasture, and a few are cultivated. This soil is generally unsuited to corn, soybeans, and small grain. Droughtiness, the slope, and the hazard of soil blowing are the major management concerns.

This soil is poorly suited to deep-rooted grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants helps to control soil blowing. Shallow-rooted legumes, such as clover, are not suited because of the low available water capacity. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality is the main management concern. Seedlings should be planted as early as possible in the spring. Also, special planting stock and overstocking are needed. Some replanting may be necessary. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings and for local roads and streets. Land shaping is needed on sites for dwellings, and cutting and filling may be needed on sites for roads and streets. Dwellings can be designed so that they conform to the natural slope of the land.

This soil is severely limited as a site for septic tank absorption fields because it has a poor filtering capacity. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Adding suitable fill material improves the filtering capacity.

The land capability classification is VIs. The woodland ordination symbol is 4S.

RIA—Riddles fine sandy loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on uplands. Individual areas are irregular in shape and are 3 to 320 acres in size. The dominant size is about 30 acres.

In a typical profile, the surface layer is dark grayish brown fine sandy loam about 10 inches thick. The subsoil is about 53 inches thick. It is dark yellowish brown. The upper part is friable sandy loam, the next part is firm sandy clay loam, and the lower part is friable loam. The underlying material to a depth of 70 inches is yellowish brown loam. In some areas the depth to the underlying material is less than 40 inches. In other areas the surface layer is loamy sand. In places the content of gravel in the underlying material is 15 percent or more. In some areas the subsoil has less clay, and in other areas it has more clay. In places the slope is more than 2 percent.

Included with this soil in mapping are a few small areas of the poorly drained Barry soils in depressions and the somewhat poorly drained, nearly level Crosier soils on the slightly lower parts of the landscape. Also included are a few small areas of the well drained Metea soils, which are more sandy than the Riddles soil, and a few areas of soils that are more slowly permeable than the Riddles soil. Included soils make up about 3 to 12 percent of the unit.

Available water capacity is high in the Riddles soil. Permeability is moderate. Surface runoff is slow. The organic matter content is low in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and a few are wooded.

This soil is well suited to corn, soybeans, and small grain. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to maintain or improve tilth and the organic matter content (fig. 5).

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Properly designing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. The soil is moderately limited as a site for local roads and streets because of low strength and frost action. Providing coarser textured base material helps to

Figure 5.—No-till corn in an area of Riddles fine sandy loam, 0 to 2 percent slopes.

prevent the damage caused by low strength and frost action.

Because of the restricted permeability, this soil is moderately limited as a site for septic tank absorption fields. Enlarging the absorption field helps to overcome this limitation.

The land capability classification is I. The woodland ordination symbol is 5A.

RlB2—Riddles fine sandy loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on broad, convex ridgetops and long side slopes in the uplands. Individual areas are generally irregular in shape and are 3 to 56 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark grayish brown fine sandy loam about 11 inches thick. It is mixed with specks and lumps of yellowish brown sandy clay loam. The subsoil is about 35 inches thick. It is yellowish brown and dark yellowish brown, firm and friable sandy clay loam and fine sandy loam. The underlying material to a depth of 60 inches is yellowish brown fine sandy loam. In a few places the surface layer is loamy sand. In some small areas the content of gravel in the underlying material is 15 percent or more. In places the subsoil has less clay, and in a few places it has more clay. In a few areas the surface layer has been mixed with the subsoil by plowing and is clay loam. In some areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are a few small areas of the poorly drained Barry soils in depressions and drainageways and the somewhat poorly drained Crosier soils on the lower parts of the landscape. Also included are a few small areas of the well drained Metea soils, which are more sandy than the Riddles soil, and a few small areas of soils that are more slowly permeable than the Riddles soil. Included soils make up about 5 to 12 percent of the unit.

Available water capacity is high in the Riddles soil. Permeability is moderate. Surface runoff is rapid. The organic matter content is low in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and a few are wooded.

This soil is well suited to corn, soybeans, and small grain. Measures that help to control erosion and surface runoff are needed. A crop rotation that includes grasses and legumes, terraces, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface also help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Properly designing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. Erosion is a hazard. It can be controlled by retaining as much of the existing vegetation as possible during construction. Stockpiling topsoil for use as the final layer and reseeding grasses as soon as possible also help to control erosion. The soil is moderately limited as a site for local roads and streets because of low strength and frost action. Providing coarser textured base material helps to prevent the damage caused by low strength and frost action.

Because of the restricted permeability, this soil is moderately limited as a site for septic tank absorption fields. Enlarging the absorption field helps to overcome this limitation.

The land capability classification is IIe. The woodland ordination symbol is 5A.

RlC2—Riddles fine sandy loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on broad, convex ridgetops, on side slopes, and along drainageways in the uplands. Individual areas are irregular in shape and are 3 to 70 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. It is mixed with specks and lumps of yellowish brown sandy loam. The subsoil is about 45 inches thick. The upper part is yellowish brown, friable sandy loam; the next part is dark yellowish brown and dark brown, firm sandy clay loam; and the lower part is yellowish brown, friable loam. The underlying material to a depth of 60 inches is brown loam. In places the depth to the underlying material is less than 40 inches. In a few places the surface layer is loamy sand less than 15 inches thick. In a few areas the soil is underlain by sand. In a few places the subsoil has less clay. In some areas the surface layer has been mixed with the subsoil and is clay loam. In a few areas the subsoil has more clay. In places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are a few small areas of the well drained Metea soils. These soils are more sandy than the Riddles soil. Their landscape

positions are similar to those of the Riddles soil. Also included are a few small areas of the somewhat poorly drained, nearly level Crosier soils; a few small areas of the poorly drained Barry soils in depressions and drainageways; and a few areas of soils that are more slowly permeable than the Riddles soil. Included soils make up about 5 to 12 percent of the unit.

Available water capacity is high in the Riddles soil. Permeability is moderate. Surface runoff is rapid in cultivated areas. The organic matter content is low in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and a few are wooded.

This soil is fairly well suited to corn, soybeans, and small grain. Measures that help to control erosion and surface runoff are needed. A crop rotation that includes grasses and legumes, terraces, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface also help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope and the shrink-swell potential, this soil is moderately limited as a site for dwellings. Properly designing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. Land shaping generally is needed. Developing random lots, retaining as much of the existing vegetation as possible, establishing housing developments and local roads on the contour, and establishing diversions that intercept runoff between lots help to control erosion. Stockpiling topsoil for use as the final layer and reseeding grasses as soon as possible also help to control erosion.

Because of low strength, slope, and frost action, this soil is moderately limited as a site for local roads and streets. Providing coarser textured base material helps to prevent the damage caused by low strength and frost action. Cutting and filling are needed, and the roads should be built on the contour if possible.

Because of the restricted permeability and the slope, this soil is moderately limited as a site for septic tank absorption fields. Enlarging the absorption field helps to overcome the restricted permeability. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

Se—Sebewa sandy clay loam. This nearly level or depressional, deep, very poorly drained soil is on broad outwash flats or in slight depressions. It is frequently ponded by runoff from the higher lying adjacent areas. Individual areas are irregular in shape and are 3 to 200 acres in size. The dominant size is about 50 acres.

In a typical profile, the surface layer is black sandy clay loam about 11 inches thick. The subsoil is about 23 inches thick. The upper part is dark gray, mottled, firm sandy clay loam; the next part is gray, mottled, firm clay loam and sandy clay loam; and the lower part is dark gray, friable gravelly coarse sandy loam. The underlying material to a depth of 60 inches is grayish brown gravelly loamy coarse sand. In places the subsoil is sandy loam. In some small areas the surface layer is thinner. In some of the lower areas, it is mucky loam. In a few areas the depth to the underlying material is less than 24 inches, and in some areas it is more than 40 inches. In places the slope is more than 2 percent.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Brady and Homer soils on the slightly higher parts of the landscape and a few small areas of the well drained Kosciusko and Ormas soils on the higher rises. Included soils make up about 5 to 12 percent of the unit.

Available water capacity is moderate in the Sebewa soil. Permeability is moderate in the subsoil and rapid in the underlying material. Surface runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions. It becomes cloddy and hard to work, however, if tilled when the soil is too wet. Also, a compact plowpan can form if the soil is tilled when it is too wet. The plowpan can restrict root growth and lower yields.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Most areas are drained by subsurface drains and open ditches. Row crops can be grown during most years in adequately drained areas. A system of conservation tillage that leaves all or part of the crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as clover, for hay or pasture. It is less well suited to deep-rooted legumes,

such as alfalfa, than to shallow-rooted legumes. A drainage system is necessary. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent excessive compaction and maintain good tilth and plant density.

This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The trees are usually harvested only during extremely dry periods or when the ground is frozen. The species that can withstand the wetness should be favored in the stands. Because of seedling mortality, special planting stock and overstocking are needed. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them too widely spaced reduce the windthrow hazard.

Because of ponding, this soil is generally unsuitable as a site for dwellings. Because of the ponding and a poor filtering capacity, it is generally unsuitable as a site for septic tank absorption fields. It is severely limited as a site for local roads because of ponding and frost action. Building the roads on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Wa—Wallkill silt loam. This nearly level or depressional, deep, very poorly drained soil is in depressions on uplands and outwash plains. It is frequently ponded for short periods early in spring. Individual areas are generally elongated and are 3 to 40 acres in size. The dominant size is about 9 acres.

In a typical profile, the surface layer is black silt loam about 10 inches thick. The subsoil is very dark gray, friable silt loam about 20 inches thick. The underlying material to a depth of 60 inches is black and dark reddish brown muck. In some areas sand is at a depth of about 50 inches. In a few places the depth to the organic material is more than 40 inches. In places the slope is more than 2 percent.

Included with this soil in mapping are a few areas of the very poorly drained, mucky Houghton soils in depressions and a few areas of the well drained Riddles and Wawasee soils on the surrounding slopes. Included soils make up about 5 to 10 percent of the unit.

Available water capacity is high in the Wallkill soil. Permeability is moderate in the mineral material and moderately rapid or rapid in the organic material. Surface runoff is very slow or ponded. The water table is near or above the surface layer during winter and spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions.

Most areas of this soil are used for cultivated crops. Some are wooded. A few are used for hay or pasture.

This soil is fairly well suited to corn, soybeans, and some small grain crops. It is poorly suited to winter wheat, however, because ponding usually destroys the stands. Wetness and ponding are the major management concerns. Excess water can be removed by subsurface drains, surface drains, pumps, or a combination of these. If drained and otherwise well managed, the soil is suited to intensive row cropping. A system of conservation tillage that leaves all or part of the crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as reed canarygrass, and legumes, such as clover, for hay or pasture. It is less well suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. A drainage system is necessary. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. The trees are usually harvested only during extremely dry periods or when the ground is frozen. The species that can withstand the wetness should be favored in the stands. Some replanting is usually needed. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them too widely spaced reduce the windthrow hazard.

Because of ponding and low strength, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of ponding and frost action. Building the roads on raised well compacted fill material, constructing roadside ditches, and installing culverts help to prevent the damage caused by ponding and frost action. Replacing the base material with better suited material improves the ability of the roads to support vehicular traffic.

The land capability classification is IIIw. The woodland ordination symbol is 3W.

Wh—Washtenaw silt loam. This nearly level or depressional, deep, very poorly drained soil is in swales and narrow depressions on moraines, till plains, and outwash plains. In winter and spring, it is frequently ponded for brief periods by runoff from the higher lying

adjacent areas. Individual areas are irregularly shaped or elongated and are 3 to 30 acres in size.

In a typical profile, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsurface layer is grayish brown silt loam about 13 inches thick. Below this is a buried soil about 27 inches thick. The upper part of the buried soil is black and very dark gray, mottled, friable fine sandy loam, and the lower part is gray, mottled, firm loam. The underlying material to a depth of 60 inches is dark grayish brown, mottled silt loam. In places the overwash is less than 20 inches thick. In some areas the soil is underlain by stratified sand and gravel. In other areas the slope is more than 2 percent. In a few small areas, organic material is below a depth of about 20 inches.

Included with this soil in mapping are a few small areas of the well drained Metea, Riddles, and Wawasee soils on the higher surrounding slopes. These soils make up about 5 to 12 percent of the unit.

Available water capacity is high in the Washtenaw soil. Permeability is moderate in the upper part of the soil and slow in the lower part. Surface runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is moderate in the surface layer. This layer becomes cloddy and hard to work if tilled when the soil is wet. Also, a compact plowpan can form if the soil is tilled when wet. The plowpan can restrict root growth and lower yields.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is well suited to corn and soybeans. It is poorly suited to winter wheat, however, because ponding usually destroys the stands. The wetness is the main limitation. Excess water can be removed by open ditches, subsurface drains, pumps, or a combination of these. A system of conservation tillage that leaves all or part of the crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as reed canarygrass, and legumes, such as clover, for hay or pasture. It is less well suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. A drainage system is necessary. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent excessive compaction and maintain good tilth and plant density.

This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The trees are usually harvested only during extremely dry periods or when the ground is frozen. The species that can withstand the wetness should be favored in the stands. Because of seedling mortality, special planting stock and overstocking are needed. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling. Thinning or harvest methods that do not isolate the remaining trees or leave them too widely spaced reduce the windthrow hazard.

Because of the restricted permeability and the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of ponding and frost action. Building the roads on raised, well compacted fill material, constructing roadside ditches, and installing culverts help to prevent the damage caused by ponding and frost action. Strengthening the base with better suited material improves the ability of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 5W.

WkB—Wawasee fine sandy loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on broad, convex ridgetops and long side slopes in the uplands. Individual areas generally are irregular in shape and are 3 to 90 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark brown fine sandy loam about 10 inches thick. The subsoil is about 29 inches thick. The upper part is dark yellowish brown, friable loam, and the lower part is dark yellowish brown, firm sandy clay loam. The underlying material to a depth of 60 inches is yellowish brown fine sandy loam. In some places the depth to the underlying material is more than 40 or less than 28 inches. In other places the underlying material has more sand and less clay. In some areas the surface layer and subsoil have more clay throughout. In severely eroded areas, the surface layer has been mixed with the subsoil by plowing and is sandy clay loam. In places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are a few small areas of the poorly drained Barry soils in depressions and the somewhat poorly drained Crosier soils on the lower parts of the landscape. Also included are some small areas of the well drained Metea soils and a few areas of soils that are more slowly permeable than the Wawasee soil. Metea soils are more sandy than the Wawasee soil. Their landscape positions are similar to those of the Wawasee soil. Included soils make up about 5 to 12 percent of the unit.

Available water capacity and permeability are moderate in the Wawasee soil. Surface runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used for hay or pasture, and a few are wooded.

This soil is well suited to corn, soybeans, and small grain. Measures that help to control erosion and surface runoff are needed. A crop rotation that includes grasses and legumes, terraces, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface also help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture (fig. 6). A cover of these plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

This soil is suitable as a site for dwellings. It is moderately limited as a site for local roads and streets because of frost action. Building the roads and streets on raised, well compacted fill material helps to prevent the damage caused by frost action. The soil is moderately limited as a site for septic tank absorption fields because of the restricted permeability. Enlarging the absorption field helps to overcome this limitation.

The land capability classification is IIe. The woodland ordination symbol is 5A.

WkC2—Wawasee fine sandy loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on broad, convex ridgetops, on side slopes, and along drainageways in the uplands. Individual areas are irregular in shape and are 3 to 75 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark brown fine sandy loam about 7 inches thick. It has specks and lumps of yellowish brown sandy loam. The subsurface layer is yellowish brown sandy loam about 4 inches thick. The subsoil is about 20 inches thick. The upper part is dark yellowish brown, firm sandy clay loam, and the lower part is dark brown, friable loam. The underlying material to a depth of 60 inches is yellowish brown loam. In places the depth to the underlying material is more than 40 inches. In a few places the surface layer is loamy sand less than 15 inches thick. In a few areas the subsoil has less clay, and in a few places it has more

Figure 6.—Permanent pasture in an area of Wawasee fine sandy loam, 2 to 6 percent slopes.

clay. In some severely eroded areas where the subsoil has been mixed with the surface soil by plowing, the surface layer is sandy clay loam. In some areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are a few small areas of the poorly drained Barry soils in depressions and the somewhat poorly drained Crosier soils on the lower parts of the landscape. Also included are some small areas of the well drained Metea soils and a few areas of soils that are more slowly permeable than the Wawasee soil. Metea soils are more sandy than the Wawasee soil. Their landscape positions are similar to those of the Wawasee soil. Included soils make up about 5 to 10 percent of the unit.

Available water capacity and permeability are moderate in the Wawasee soil. Surface runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and a few are wooded.

This soil is fairly well suited to corn, soybeans, and small grain. Measures that help to control erosion and surface runoff are needed. A crop rotation that includes grasses and legumes, terraces, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface also help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. A cover of these plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. Land shaping generally is needed. Developing random lots, retaining as much of the existing vegetation as possible, establishing housing developments and local roads on the contour, and establishing diversions that intercept runoff between lots help to control erosion. Stockpiling topsoil for use as the final layer and reseeding grasses as soon as possible also help to control erosion.

This soil is moderately limited as a site for local roads and streets because of slope and frost action. Providing coarser textured base material helps to prevent the damage caused by frost action. Cutting and filling are needed, and the roads should be built on the contour if possible.

Because of the slope and the restricted permeability, this soil is moderately limited as a site for septic tank absorption fields. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly. Enlarging the absorption field helps to overcome the restricted permeability.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

WkD—Wawasee fine sandy loam, 12 to 18 percent slopes. This strongly sloping, deep, well drained soil is on narrow ridgetops, on side slopes, and along drainageways in the uplands. Individual areas generally are longer than they are wide and are 3 to 15 acres in size.

In a typical profile, the surface layer is dark brown fine sandy loam about 4 inches thick. The subsurface layer is brown sandy loam about 10 inches thick. The subsoil is yellowish brown, friable loam about 21 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the depth to the underlying material is more than 40 inches. In other places the surface layer is loamy sand less than 15 inches thick. In some areas the subsoil has less clay, and in a few it has more clay. In some farmed areas the soil is severely eroded. In areas where the subsoil has been mixed with the surface soil by plowing, the surface layer is sandy clay loam. In places the slope is less than 12 or more than 18 percent.

Included with this soil in mapping are a few small areas of the poorly drained Barry soils in depressions and the somewhat poorly drained Crosier soils on the lower parts of the landscape. Also included are some small areas of the well drained Metea soils and a few areas of soils that are more slowly permeable than the Wawasee soil. Metea soils are more sandy than the Wawasee soil. Their landscape positions are similar to those of the Wawasee soil. Included soils make up about 5 to 10 percent of the unit.

Available water capacity and permeability are moderate in the Wawasee soil. Surface runoff is rapid. The organic matter content is moderate in the surface layer. This layer is friable.

Most areas of this soil are used for hay or pasture. Some are used for cultivated crops, and a few are wooded.

Because of the slope, this soil is poorly suited to cultivated crops. Measures that help to control erosion and surface runoff are needed. A crop rotation dominated by grasses and legumes, terraces, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or part of the crop

residue on the surface also help to control erosion and improve or maintain tilth and the organic matter content.

This soil is fairly well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of these plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The erosion hazard, the equipment limitation, and plant competition are the main management concerns. Because of the erosion hazard, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, culverts, and drop structures. During wet periods, the roads tend to be slippery and ruts form easily. Seedling survival and growth rates can be increased if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is severely limited as a site for dwellings. Land shaping generally is needed. Developing random lots, retaining as much of the existing vegetation as possible, establishing housing developments and local roads on the contour, and establishing diversions that intercept runoff between lots help to control erosion. Stockpiling topsoil for use as the final layer and reseeding grasses as soon as possible also help to control erosion. The soil is severely limited as a site for local roads and streets because of the slope. Cutting and filling are needed, and the roads should be built on the contour if possible.

Because of the slope, this soil is severely limited as a site for septic tank absorption fields. Also, the restricted permeability is a moderate limitation. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly. Enlarging the absorption field helps to overcome the restricted permeability.

The land capability classification is IVe. The woodland ordination symbol is 5R.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 167,000 acres in Fulton County, or more than 70 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county. Nearly all of the prime farmland is used for corn and soybeans.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Charles H. Coffing, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 163,348 acres in Fulton County was used for crops and pasture in 1982. Of this total, 131,382 acres was used for row crops, mainly corn and soybeans; 11,502 acres for close-grown crops, mainly wheat and some oats; 8,375 acres for permanent pasture; and 37 acres for vegetable crops.

The potential of the soils in Fulton County for increased production of food is fair. In 1967, about 11,744 acres of potentially good cropland was used as woodland and about 15,552 acres as pasture (*4*). In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all of the cropland in the county. This soil survey can greatly facilitate the application of such technology.

The paragraphs that follow describe the major management concerns in the areas of the county used for crops and pasture. These concerns include drainage, water erosion, soil blowing, fertility, and tilth.

Soil drainage is the major management concern on about 20 percent of the cropland and pasture in the county. Most of the very poorly drained soils, such as Barry, Cohoctah, Houghton, Newton, and Sebewa soils, have been drained. A few areas of these soils, however, cannot be economically drained. They are depressional areas where deep drainage ditches to a suitable outlet would have to extend for great distances. Examples are many areas of Houghton soils, where pumps may be needed. Some of the soils that have a high water table cannot be easily drained because they are sandy. Open ditches constructed in these soils commonly are not stable and tend to fill in over a period of a few years. When this filling occurs, the capacity of the open ditches and the subsurface drains outletting into them is severely affected.

Unless drained, somewhat poorly drained soils are so wet that crops are damaged during most years.

Examples are Blount, Brady, Crosier, and Markton soils, which make up about 47,000 acres in the county.

The well drained Morley, Riddles, and Wawasee soils tend to dry out slowly after rains. Small areas of wetter soils along drainageways and in swales are commonly included in areas of these soils, especially those that have a slope of 2 to 6 percent. A drainage system is needed in some of these wetter areas.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface drains, open ditches, and subsurface drains is needed in most areas of the very poorly drained soils used for intensive row cropping. Drains should be more closely spaced in slowly permeable soils than in more permeable soils. Subsurface drainage is slower in Barry, Blount, and Crosier soils than in Brady, Houghton, Newton, and Sebewa soils. Finding adequate drainage outlets is difficult in many areas of Adrian, Gilford, Houghton, and Muskego soils.

Organic soils oxidize and subside when their pore space is filled with air. Therefore, special drainage systems are needed to control the depth and period of drainage. Keeping the water table at the level required by the crops during the growing season and raising it to the surface during other parts of the year reduce the rates of oxidation and subsidence.

Information about the design of drainage systems for each kind of soil is available in local offices of the Soil Conservation Service.

Water erosion is the major management concern on about 38 percent of the cropland and pasture in the county (*4*). It is a hazard if the slope is more than 2 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced and tilth deteriorates as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Morley soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Chelsea, Kosciusko, Ormas, and Plainfield soils. Second, erosion results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves water quality for municipal use, for recreation, and for fish and other wildlife.

On clayey or hardpan spots in many sloping fields, preparing a good seedbed and tilling are difficult because the original friable surface soil has been eroded away. Such spots are common in areas of the moderately eroded Morley and Riddles soils.

Erosion-control practices provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a vegetative cover on the soil for extended periods can hold soil losses to an amount that does not reduce the productive capacity of the soils. A soil-building program is needed because erosion has been severe on many of the soils in the county. On livestock farms, where pasture and hay are needed, including forage crops of grasses and legumes in the cropping sequence reduces the susceptibility of the more sloping areas to erosion and provides nitrogen and improves tilth for the following crop.

Because of slopes that are too short and irregular, contour farming is not practical on most of the more sloping soils in the county. On these soils a conservation tillage system or a cropping system that provides a substantial vegetative cover is needed to control erosion. In the more sloping areas, these systems are most effective when used in conjunction with water- and sediment-control basins. Minimizing tillage and leaving crop residue on the surface increase the rate of water infiltration and reduce the runoff rate and the hazard of erosion. They are suitable practices on most of the soils in the county. No-tillage is effective in controlling erosion in the more sloping areas (fig. 7). It can be effective on the well drained and droughty soils in the county. Till-plant and chiseling are more effective on the wetter soils that have more clay in the surface layer.

Diversions and parallel tile-outlet terraces shorten the length of slopes and are thus effective in reducing the susceptibility to sheet, rill, and gully erosion. They are most practical on deep, well drained soils that are highly susceptible to erosion. Terraces reduce soil loss and the associated loss of fertilizer elements, help to prevent the damage to crops and watercourses caused by eroding sediment, and help to eliminate the need for grassed waterways and erosion-control structures, which take productive land out of row crop production. Leveling and land shaping make farming easier and thus reduce the amount of pesticides entering watercourses. Morley, Riddles, and Wawasee soils are suitable for terracing.

Because of the large number of open ditches in the county, grade stabilization structures are needed. These structures reduce the susceptibility to erosion in areas where surface water drains into an open ditch.

Soil blowing is a hazard in drained areas of Adrian, Edwards, Houghton, and Muskego soils. It can damage these mucks and young crops growing on the soils in a few hours if winds are strong and the soils are dry and have no vegetation or surface mulch. Maintaining a cover of vegetation or mulch, keeping the surface rough through proper tillage methods, and growing windbreaks of suitable shrubs help to control soil blowing on these soils. Soil blowing also is a hazard in bare areas of the sandy Branch, Chelsea, Metea, Ormas, and Plainfield soils and on Brady, Gilford, and Newton soils. Soils that are plowed in the fall are highly susceptible to soil blowing during the following spring. Winter cover crops and a conservation tillage system that leaves all or part of the crop residue on the surface help to control soil blowing on these soils.

Soil fertility is naturally low or medium in most of the soils on uplands in the county. These soils tend to be

Figure 7.—No-till corn planted into wheat stubble in an area of Wawasee soils.

strongly acid or medium acid unless they are limed. Applications of ground limestone generally are needed to raise the pH level sufficiently for good production of alfalfa and other crops that grow well on nearly neutral soils. Available phosphorus and potash levels are naturally low in most of these soils.

The soils on flood plains, such as Cohoctah soils, are neutral and are naturally higher in content of plant nutrients than most upland soils. The very poorly drained soils, such as Barry and Pewamo soils, are in slight depressions and receive runoff from the adjacent upland soils. They generally are slightly acid or neutral.

On all soils additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service and many local fertilizer dealers can help in determining the kinds and amounts of fertilizer and lime needed.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous.

Some of the soils used for crops in the county have a loam or sandy loam surface layer that is dark and moderate in content of organic matter. Generally, the

structure of these soils is moderate or weak, and a crust forms on the surface during periods of heavy rainfall. In some areas the crust is hard and impervious to water when dry. As a result, it reduces the rate of water infiltration and increases the runoff rate. Regular additions of crop residue, manure, and other organic material can improve soil structure and help to prevent excessive crusting.

Fall plowing generally is not suitable on the light colored soils because it can result in crusting during winter and spring. Also, about 34 percent of the cropland in the county occurs as areas of the more sloping soils that are subject to erosion if they are plowed in the fall.

Tilth is a problem in the dark Barry, Pewamo, and Sebewa soils, which often stay wet until late in spring. These soils have a high content of clay. If plowed when wet, they lose their structure and friability, develop plowpans, and tend to be very cloddy when dry. As a result, preparing a good seedbed is difficult. Fall plowing or chiseling when the soil is not wet generally results in good tilth in the spring.

Field crops suited to the soils and climate in the county include many that are not commonly grown. Corn and soybeans are the main row crops. Wheat, oats, and rye are the chief close-growing crops. Grass seed could be produced from bromegrass, fescue, orchardgrass, reed canarygrass, and bluegrass.

Specialty crops are of limited commercial importance in the county. A small acreage is used for blueberries (fig. 8), apples, vegetables, sweet corn, and nursery crops. Other specialty crops include Christmas trees, popcorn, and sunflowers. Deep, well drained soils that warm up early in spring are especially well suited to many vegetables and small fruits. Examples are the Kosciusko, Ormas, and Wawasee soils that have a slope of less than 6 percent. If the Kosciusko and Ormas soils were used for specialty crops, irrigation would be needed. Crops can generally be planted and harvested earlier on these soils than on other soils in the county.

If adequately drained, mucks are well suited to mint and a wide range of vegetable crops. Adrian, Edwards, Houghton, and Muskego mucks are examples. They make up about 19,500 acres in the county.

Most of the well drained soils in the county are suitable for orchards and nursery plants. Most of the soils in low positions where frost is frequent and air drainage is poor are poorly suited to early vegetables, small fruits, and orchards. Because of an insufficient acreage of organic soils in any one area, the production of some specialty crops may not be economical.

The latest information about growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and

Figure 8.—Blueberries in an area of Newton soils.

narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have

other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Michael D. Warner, forester, Soil Conservation Service, helped prepare this section.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

James D. McCall, biologist, Soil Conservation Service, helped prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, soybeans, wheat, oats, sorghum, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are timothy, bromegrass, bluegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, ragweed, pokeweed, sheep sorrel, dock, crabgrass, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are maple, beech, oak, poplar, wild cherry, willow, black walnut, apple, hawthorn, dogwood, hickory, hazelnut, elderberry, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are autumn-olive, highbush cranberry, crabapple, Washington hawthorn, and shrub dogwood.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, tamarack, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, spikeweed, wild millet, cattail, waterplantain, arrowhead, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, dove, pheasant, meadowlark, field sparrow, cottontail, red fox, and woodchuck.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include

woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Edge habitat consists of the areas where major land uses or cover types adjoin. A good example is the border between dense woodland and a field of no-till corn. Although not rated in the table, edge habitat is of primary importance to animals from the smallest songbirds to white-tailed deer. Most of the animals that inhabit openland or woodland also frequent edge habitat, and desirable edge areas are consistently used by 10 times as many wildlife as are the centers of large areas of woodland or cropland.

Engineering

Max L. Evans, conservation engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the

excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the

lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large

stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

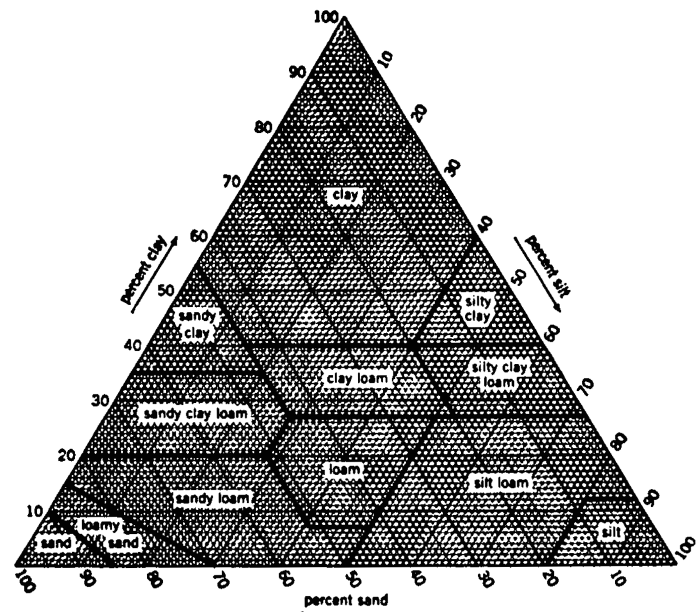


Figure 9.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 9). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of

grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to

buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*5*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Adrian Series

The Adrian series consists of deep, very poorly drained soils in depressions on outwash plains, till plains, and moraines. These soils formed in organic material over sandy material. They are moderately slowly permeable to moderately rapidly permeable in the organic material and rapidly permeable in the underlying sandy material. Slopes range from 0 to 2 percent.

Adrian soils are similar to Edwards, Houghton, and Muskego soils and are adjacent to Newton soils. Edwards soils have organic material that is 16 to 49 inches deep over marl. Houghton soils have organic

material that is more than 51 inches thick. Muskego soils have organic material that is 16 to 50 inches deep over coprogenous earth. Newton soils do not have an organic surface layer.

Typical pedon of Adrian muck, drained, in a cultivated field; 80 feet east and 980 feet south of the northwest corner of sec. 29, T. 29 N., R. 1 E.

Op—0 to 11 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 40 percent fiber, 1 percent rubbed; moderate fine granular structure; friable; many fine and medium roots; dark brown (10YR 3/3) sodium pyrophosphate; primarily herbaceous fibers; strongly acid; abrupt smooth boundary.

Oa—11 to 27 inches; sapric material, very dark brown (10YR 2/2) broken face and rubbed; about 72 percent fiber, 8 percent rubbed; moderate coarse subangular blocky structure; friable; common fine roots; light yellowish brown (10YR 6/4) sodium pyrophosphate; primarily herbaceous fibers; common yellowish brown (10YR 5/4) decaying plant parts; strongly acid; abrupt wavy boundary.

2C1—27 to 40 inches; dark gray (10YR 4/1) sand; single grain; loose; few very dark brown (10YR 2/2) organic accumulations; about 3 percent fine gravel; neutral; clear wavy boundary.

2C2—40 to 60 inches; very dark gray (10YR 3/1) sand; single grain; loose; about 10 percent fine gravel; weak effervescence; mildly alkaline.

The depth to the sandy 2C horizon is 16 to 50 inches. The organic fibers are derived primarily from herbaceous plants. Reaction, tested in 0.01M calcium chloride, ranges from strongly acid to neutral throughout the organic material.

The surface tier is black (N 2/0 or 10YR 2/1). After rubbing, the content of fiber is typically less than 10 percent. The subsurface tier has hue of 5YR, 7.5YR, or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. The 2C horizon is sand or loamy sand. It ranges from slightly acid to moderately alkaline.

Algansee Series

The Algansee series consists of deep, somewhat poorly drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. Slopes range from 0 to 2 percent.

Algansee soils are adjacent to Cohoctah soils. The adjacent soils are poorly drained and very poorly drained and are in the slightly lower areas. They have a surface layer that is thicker and darker than that of the Algansee soils and are dominantly grayish throughout.

Typical pedon of Algansee loamy sand, frequently flooded, in a wooded area; 2,240 feet north and 200 feet east of the southwest corner of sec. 25, T. 31 N., R. 2 E.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; moderate medium granular structure; very friable; neutral; clear wavy boundary.

C1—5 to 22 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine granular structure; very friable; neutral; clear wavy boundary.

C2—22 to 33 inches; yellowish brown (10YR 5/4) sand; few fine faint pale brown (10YR 6/3) and dark yellowish brown (10YR 4/4) mottles; single grain; loose; neutral; clear wavy boundary.

C3—33 to 42 inches; light brownish gray (10YR 6/2) sand; common medium distinct yellowish brown (10YR 5/6) and few medium prominent yellowish red (5YR 4/6) and strong brown (7.5YR 4/6) mottles; single grain; loose; strong effervescence; mildly alkaline; clear wavy boundary.

C4—42 to 60 inches; yellowish brown (10YR 5/4) sand; common medium distinct light brownish gray (10YR 6/2) and few medium prominent yellowish red (5YR 4/6) mottles; single grain; loose; strong effervescence; mildly alkaline.

The A and C horizons are loamy sand, loamy fine sand, sand, or fine sand. They are slightly acid to mildly alkaline. The A horizon has value of 3 or 4 and chroma of 1 or 2. The C horizon has value of 4 to 6 and chroma of 2 to 4.

Barry Series

The Barry series consists of deep, poorly drained, moderately permeable soils on glacial till plains. These soils formed in glacial till. Slopes range from 0 to 2 percent.

Barry soils are similar to Gilford and Sebewa soils and are adjacent to Crosier, Riddles, and Wawasee soils. Gilford soils are sandy in the upper part. Sebewa soils are sandy in the underlying material. Crosier, Riddles, and Wawasee soils are browner than the Barry soils. They are in the higher positions on the landscape.

Typical pedon of Barry loam, in a cultivated field; 120 feet east and 980 feet north of the southwest corner of sec. 24, T. 31 N., R. 3 E.

Ap—0 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate fine and medium granular structure; friable; slightly acid; abrupt smooth boundary.

A—10 to 13 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; slightly acid; clear wavy boundary.

Btg1—13 to 22 inches; dark gray (10YR 4/1) sandy clay loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine and medium subangular blocky structure; firm; thin patchy dark

gray (10YR 4/1) clay films on faces of peds; about 2 percent fine gravel; neutral; clear wavy boundary.

Btg2—22 to 28 inches; gray (10YR 5/1) fine sandy loam; common medium distinct dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure; firm; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; about 2 percent fine gravel; neutral; clear wavy boundary.

BCg—28 to 41 inches; gray (10YR 5/1) fine sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure; firm; clay bridges between sand grains; about 5 percent fine gravel; neutral; clear wavy boundary.

C—41 to 60 inches; pale brown (10YR 6/3) loam; massive; friable; about 7 percent fine gravel; strong effervescence; moderately alkaline.

The solum is 30 to 50 inches thick. It is slightly acid or neutral. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is loam, sandy loam, or silt loam. The Btg horizon has value of 4 or 5 and chroma of 1 or 2. It is loam, fine sandy loam, or sandy clay loam. The C horizon has value of 5 or 6 and chroma of 1 to 3.

Blount Series

The Blount series consists of deep, somewhat poorly drained, slowly permeable or moderately slowly permeable soils on till plains. These soils formed in glacial till. Slopes range from 0 to 2 percent.

Blount soils are similar to Crosier soils and are adjacent to Morley and Pewamo soils. Crosier soils have more sand and less clay throughout than the Blount soils. Morley soils are well drained and are in the higher lying areas. They do not have mottles in the upper part of the B horizon. Pewamo soils are very poorly drained and are in depressional areas. They have a thick, dark surface layer.

Typical pedon of Blount loam, 0 to 2 percent slopes, in a cultivated field; 700 feet south and 120 feet west of the northeast corner of sec. 30, T. 30 N., R. 5 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; about 1 percent gravel; strongly acid; abrupt smooth boundary.

Bt1—8 to 15 inches; dark yellowish brown (10YR 4/4) clay; common medium distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; few fine roots; thick continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent fine gravel; very strongly acid; clear wavy boundary.

Bt2—15 to 21 inches; brown (10YR 4/3) clay; common medium distinct gray (10YR 5/1) and dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thick continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent fine gravel; strongly acid; clear wavy boundary.

Bt3—21 to 28 inches; brown (10YR 4/3) clay; common medium faint grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse angular blocky structure; firm; thick continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent fine gravel; neutral; clear wavy boundary.

Bt4—28 to 38 inches; dark yellowish brown (10YR 4/4) clay loam; few fine prominent strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 6 percent gravel (I percent more than 0.75 inch in diameter); strong effervescence; mildly alkaline; clear wavy boundary.

C—38 to 60 inches; brown (10YR 4/3) and dark gray (10YR 4/1) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; common fine light gray (10YR 7/2) coatings on faces of peds; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness. The A horizon has chroma of 1 or 2. The Bt horizon has value of 4 to 6 and chroma of 2 to 4. It ranges from very strongly acid in the upper part to mildly alkaline in the lower part.

Brady Series

The Brady series consists of deep, somewhat poorly drained soils on outwash plains, valley trains, and lake plains. These soils are moderately rapidly permeable. They formed in loamy and sandy glaciofluvial deposits. Slopes range from 0 to 2 percent.

Brady soils are similar to Markton soils and are adjacent to Branch, Gilford, Ormas, and Sebewa soils. Markton and Branch soils have more sand in the upper part than the Brady soils. Branch soils are moderately well drained. Gilford and Sebewa soils are very poorly drained. They are dominantly grayish throughout the solum. Also, Sebewa soils have more clay in the solum than the Brady soils. Ormas soils are well drained and are on the higher knolls and rises. They are browner than the Brady soils.

Typical pedon of Brady sandy loam, in a cultivated field; 225 feet north and 560 feet west of the southeast corner of sec. 34, T. 30 N., R. 2 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure;

friable; common fine roots; about 13 percent fine gravel; medium acid; abrupt smooth boundary.

Bt1—8 to 18 inches; dark brown (10YR 4/3) sandy loam; common fine distinct yellowish brown (10YR 5/4) mottles; moderate fine and medium subangular blocky structure; friable; few fine roots; about 15 percent fine gravel; medium acid; clear wavy boundary.

Bt2—18 to 25 inches; dark grayish brown (10YR 4/2) sandy loam; common fine and medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; gray (10YR 5/1) clay bridges between sand grains; about 5 percent fine gravel; slightly acid; clear wavy boundary.

Bt3—25 to 29 inches; dark grayish brown (10YR 4/2) gravelly sandy clay loam; many medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; dark gray (10YR 4/1) clay bridges between sand grains; about 24 percent fine gravel and shale fragments; slightly acid; clear wavy boundary.

Bg—29 to 35 inches; grayish brown (10YR 5/2) coarse sandy loam; weak coarse subangular blocky structure; friable; about 10 percent fine gravel; neutral; clear wavy boundary.

2BC—35 to 45 inches; brown (10YR 5/3) loamy sand; weak coarse subangular blocky structure; very friable; about 2 percent fine gravel; neutral; clear wavy boundary.

2C1—45 to 56 inches; pale brown (10YR 6/3) sand; single grain; loose; about 2 percent fine gravel; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—56 to 60 inches; dark yellowish brown (10YR 4/4) coarse sand; single grain; loose; about 11 percent fine gravel; strong effervescence; moderately alkaline.

The solum ranges from 40 to 58 inches in thickness. The content of coarse fragments ranges from 1 to 25 percent in the solum.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is loamy sand or sandy loam. The Bt horizon has value of 4 or 5 and chroma of 2 to 6. It is sandy loam, sandy clay loam, gravelly sandy clay loam, or loamy sand and has layers of sand in some pedons. The 2C horizon has value of 4 to 6 and chroma of 1 to 6. It is stratified sand, coarse sand, and gravelly coarse sand.

Branch Series

The Branch series consists of deep, moderately well drained soils on outwash plains. These soils are moderately rapidly permeable in the subsoil and very rapidly permeable in the underlying material. They formed in sandy and loamy glacial outwash. Slopes range from 0 to 2 percent.

Branch soils are adjacent to Brady, Gilford, and Ormas soils. Brady soils are somewhat poorly drained. They have less sand in the upper part than the Branch soils. Gilford soils are very poorly drained and are in the lower areas. They have a surface layer that is thicker and darker than that of the Branch soils and have a grayish subsoil. Ormas soils are well drained and are in the higher areas. They are browner than the Branch soils.

Typical pedon of Branch loamy sand, 0 to 2 percent slopes, in a cultivated field; 1,450 feet west and 2,900 feet north of the southeast corner of sec. 6, T. 31 N., R. 4 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; medium acid; abrupt smooth boundary.

E1—9 to 15 inches; dark brown (10YR 4/3) loamy sand; weak coarse subangular blocky structure; very friable; medium acid; clear wavy boundary.

E2—15 to 22 inches; yellowish brown (10YR 5/4) loamy sand; weak coarse subangular blocky structure; very friable; about 2 percent fine gravel; medium acid; clear wavy boundary.

2Bt1—22 to 31 inches; yellowish brown (10YR 5/4) gravelly loamy sand; common medium distinct gray (10YR 6/1) and common medium faint brown (7.5YR 5/4) mottles; weak coarse subangular blocky structure; friable; clay bridges between sand grains; about 18 percent fine gravel; very strongly acid; clear wavy boundary.

2Bt2—31 to 37 inches; dark yellowish brown (10YR 4/4) gravelly fine sandy loam; common medium distinct gray (10YR 6/1) and common medium prominent reddish yellow (7.5YR 6/6) mottles; weak coarse subangular blocky structure; friable; clay bridges between sand grains; about 20 percent fine gravel; very strongly acid; abrupt wavy boundary.

2BC—37 to 45 inches; dark yellowish brown (10YR 4/4) gravelly loamy sand; common medium faint brown (7.5YR 5/4) mottles; weak coarse subangular blocky structure; very friable; about 25 percent fine gravel; very strongly acid; clear wavy boundary.

2C—45 to 60 inches; yellowish brown (10YR 5/4) very gravelly loamy coarse sand; single grain; loose; about 50 percent fine gravel; strong effervescence; moderately alkaline.

The solum ranges from 40 to 55 inches in thickness. The A and E horizons are sand or loamy sand. The A horizon has value of 3 or 4 and chroma of 2 to 4. The E horizon has value of 4 or 5 and chroma of 3 to 5. It is medium acid or strongly acid. The 2Bt horizon has value of 4 or 5 and chroma of 4 to 6 and is mottled. It is loamy sand or gravelly loamy sand in the upper part and sandy loam or gravelly fine sandy loam in the lower part. It is strongly acid or very strongly acid. The 2C horizon is

coarse sand, gravelly coarse sand, or very gravelly loamy coarse sand. It is mildly alkaline or moderately alkaline.

Brems Series

The Brems series consists of deep, moderately well drained, rapidly permeable soils on outwash plains. These soils formed in sandy material. Slopes range from 0 to 3 percent.

Brems soils are adjacent to Brady, Chelsea, and Plainfield soils. Brady soils are somewhat poorly drained and have more clay in the subsoil than the Brems soils. They are in landscape positions similar to those of the Brems soils. Chelsea and Plainfield soils do not have grayish mottles in the lower part of the solum. They are in the higher areas. Also, Chelsea soils are excessively drained and have thin bands of more clayey material in the lower part of the solum.

Typical pedon of Brems loamy sand, 0 to 3 percent slopes, in a cultivated field; 2,520 feet west and 560 feet north of the southeast corner of sec. 6, T. 30 N., R. 2 E.

Ap—0 to 12 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; strongly acid; abrupt smooth boundary.

Bw1—12 to 22 inches; brownish yellow (10YR 6/6) loamy fine sand; weak coarse subangular blocky structure parting to single grain; very friable; very strongly acid; clear wavy boundary.

Bw2—22 to 29 inches; pale brown (10YR 6/3) fine sand; few fine distinct light gray (10YR 7/2) and common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; very strongly acid; clear wavy boundary.

Bw3—29 to 37 inches; light yellowish brown (10YR 6/4) fine sand; many medium distinct light gray (10YR 7/2) mottles; single grain; loose; very strongly acid; clear wavy boundary.

Bw4—37 to 43 inches; light yellowish brown (10YR 6/4) fine sand; common medium distinct light gray (10YR 7/2) mottles; single grain; loose; very strongly acid; clear wavy boundary.

Bw5—43 to 50 inches; pale brown (10YR 6/3) fine sand; common medium distinct brownish yellow (10YR 6/6) mottles; single grain; loose; strongly acid; clear wavy boundary.

BC—50 to 67 inches; light yellowish brown (10YR 6/4) fine sand; common medium distinct light gray (10YR 7/2) mottles; thin yellowish brown (10YR 5/6) streaks; massive; very friable; medium acid; clear wavy boundary.

C—67 to 80 inches; brown (10YR 5/3) fine sand; single grain; loose; medium acid.

The solum ranges from 40 to 70 inches in thickness. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is sand or loamy sand. It ranges from slightly acid to strongly acid. The Bw horizon has value of 5 or 6 and chroma of 3 to 8. It is fine sand, sand, loamy fine sand, or loamy sand. It ranges from very strongly acid to medium acid. The C horizon has value of 5 or 6 and chroma of 2 to 4. It is fine sand, sand, or loamy sand. It ranges from strongly acid to slightly acid.

Chelsea Series

The Chelsea series consists of deep, excessively drained, rapidly permeable soils on outwash plains and uplands. These soils formed in sandy outwash and windblown sandy material. Slopes range from 2 to 6 percent.

Chelsea soils are similar to Ormas soils and are adjacent to Brems soils. Ormas soils are well drained and have more clay in the B horizon than the Chelsea soils. Brems soils are moderately well drained, have grayish mottles in the lower part of the solum, and do not have argillic bands.

Typical pedon of Chelsea fine sand, 2 to 6 percent slopes, in a cultivated field; 1,440 feet west and 1,120 feet south of the northeast corner of sec. 27, T. 30 N., R. 1 E.

Ap—0 to 10 inches; dark brown (10YR 3/3) fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

E1—10 to 27 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; common fine roots; neutral; clear wavy boundary.

E2—27 to 44 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; common fine roots; slightly acid; clear wavy boundary.

E&B—44 to 80 inches; yellowish brown (10YR 5/4) sand (E); single grain; loose; dark yellowish brown (10YR 4/4) loamy sand bands (Bt) 0.5 inch to 2.0 inches thick, with a total thickness of about 4 inches; bands at depths of 46, 50, 54, 57, 63, and 68 inches; massive in the bands; very friable; few fine roots; about 9 percent fine gravel in the bands; slightly acid.

The solum is 4 to 10 feet thick. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is loamy fine sand or fine sand. The upper part of the E horizon has value of 4 or 5 and chroma of 2 to 6. The lower part has value of 5 or 6 and chroma of 4 to 6. The lamellae in the E&Bt horizon have hue of 7.5YR or 10YR and value of 3 or 4. They are sandy loam or loamy sand.

Cohoctah Series

The Cohoctah series consists of deep, poorly drained and very poorly drained, moderately rapidly permeable

soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Cohoctah soils are similar to Gilford soils and are adjacent to Algansee soils. Gilford soils decrease regularly in content of organic matter as depth increases. They are in the uplands. Algansee soils are somewhat poorly drained and are in the slightly higher areas. They are browner than the Cohoctah soils.

Typical pedon of Cohoctah fine sandy loam, occasionally flooded, in a cultivated field; 120 feet west and 400 feet north of the southeast corner of sec. 8, T. 30 N., R. 2 E.

Ap—0 to 11 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

A—11 to 21 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; many moderate and coarse distinct dark grayish brown (10YR 4/2) mottles; weak coarse subangular blocky structure; friable; few fine roots; slightly acid; abrupt wavy boundary.

Cg1—21 to 24 inches; gray (10YR 5/1) loam; few fine prominent light yellowish brown (2.5Y 6/4) mottles; moderate medium subangular blocky structure; firm; neutral; abrupt wavy boundary.

Cg2—24 to 31 inches; very dark gray (10YR 3/1) silt loam that has thin strata of grayish brown (10YR 5/2) sand and dark gray (10YR 4/1) sandy loam about 0.25 to 0.5 inch thick; weak coarse subangular blocky structure; friable; about 1 percent fine gravel; neutral; clear wavy boundary.

Cg3—31 to 39 inches; gray (10YR 5/1) sand that has thin lenses of sandy loam; many medium and coarse distinct light yellowish brown (10YR 6/4) mottles; weak coarse subangular blocky structure; very friable; about 5 percent fine gravel; strong effervescence; moderately alkaline; abrupt wavy boundary.

Cg4—39 to 56 inches; gray (10YR 5/1) silt loam; many coarse distinct yellowish brown (10YR 5/6) mottles; massive; friable; strong effervescence; mildly alkaline; abrupt wavy boundary.

Cg5—56 to 60 inches; grayish brown (10YR 5/2) sand; single grain; loose; strong effervescence; mildly alkaline.

Reaction is slightly acid or neutral to a depth of about 30 inches and is mildly alkaline or moderately alkaline below that depth. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is loam, fine sandy loam, or sandy loam. The C horizon has value of 3 to 6 and chroma of 1 or 2.

Crosier Series

The Crosier series consists of deep, somewhat poorly drained, moderately slowly permeable soils on uplands. These soils formed in loamy glacial till. Slopes range from 0 to 2 percent.

Crosier soils are similar to Blount, Homer, and Markton soils and are adjacent to Barry, Riddles, and Wawasee soils. Blount soils have more clay throughout than the Crosier soils. Homer soils have sand and gravelly coarse sand in the underlying material. Markton soils have more sand in the upper part than the Crosier soils. Barry soils are poorly drained and are in the lower areas. They have a surface layer that is thicker and darker than that of the Crosier soils and are dominantly grayish throughout the solum. Riddles and Wawasee soils are well drained and are in the higher areas. They have a subsoil that is browner than that of the Crosier soils.

Typical pedon of Crosier loam, 0 to 2 percent slopes, in a cultivated field; Michigan Road Land; 1,420 feet east and 80 feet north of the southwest corner of sec. 25, T. 31 N., R. 3 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common fine roots; about 2 percent fine gravel; medium acid; abrupt smooth boundary.

E—9 to 12 inches; grayish brown (10YR 5/2) loam; common fine distinct dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; friable; few fine roots; few fine black (10YR 2/1) iron and manganese oxide accumulations; about 5 percent fine gravel; slightly acid; clear wavy boundary.

Bt1—12 to 18 inches; grayish brown (10YR 5/2) clay loam; common medium faint dark brown (10YR 4/3) and dark yellowish brown (10YR 4/6) mottles; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin continuous gray (10YR 5/1) clay films on faces of peds; few fine black (10YR 2/1) iron and manganese oxide accumulations; about 5 percent fine gravel; slightly acid; clear wavy boundary.

Bt2—18 to 36 inches; dark brown (10YR 4/3) clay loam; common medium distinct yellowish brown (10YR 5/6) and common medium faint grayish brown (10YR 5/2) mottles; moderate coarse and very coarse subangular blocky structure; firm; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; about 5 percent fine gravel; slightly acid; clear wavy boundary.

Bt3—36 to 39 inches; grayish brown (10YR 5/2) loam; many medium distinct dark yellowish brown (10YR 4/6) mottles; moderate coarse subangular blocky structure; firm; thick discontinuous dark brown (10YR 4/3) clay films on faces of peds; about 7

percent fine gravel; mildly alkaline; clear wavy boundary.

C—39 to 60 inches; brown (10YR 5/3) fine sandy loam; few fine distinct strong brown (7.5YR 5/6) mottles; massive; firm; about 8 percent fine gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 24 to 40 inches. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is loam or sandy loam. The Bt horizon has value of 4 or 5 and chroma of 2 to 6. It is clay loam, loam, or sandy clay loam. It is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. The C horizon has value of 5 or 6 and chroma of 2 to 4.

Edwards Series

The Edwards series consists of deep, very poorly drained soils in depressions and on flats on outwash plains, till plains, and moraines. These soils formed in organic material over marl. Permeability is moderately slow to moderately rapid in the organic material and varies in the marl. Slopes range from 0 to 2 percent.

Edwards soils are similar to Adrian, Houghton, and Muskego soils. Adrian soils have organic material that is 16 to 50 inches deep over sandy material. Houghton soils have organic material that is more than 51 inches thick. Muskego soils have organic material that is 16 to 50 inches deep over coprogenous earth.

Typical pedon of Edwards muck, drained, in a cultivated field; 2,450 feet east and 1,200 feet north of the southwest corner of sec. 8, T. 30 N., R. 4 E.

Op—0 to 11 inches; sapric material, black (N 2/0) broken face and rubbed; about 56 percent fiber, 2 percent rubbed; moderate fine granular structure; friable; many fine roots; very dark grayish brown (10YR 3/2) sodium pyrophosphate; primarily herbaceous fibers; very strongly acid; abrupt smooth boundary.

Oa1—11 to 22 inches; sapric material, very dark gray (10YR 3/1) broken face, black (10YR 2/1) rubbed; about 62 percent fiber, 2 percent rubbed; moderate medium subangular blocky structure; friable; common fine roots; light yellowish brown (10YR 6/4) sodium pyrophosphate; common fine roots; primarily herbaceous fibers; very strongly acid; clear wavy boundary.

Oa2—22 to 33 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 68 percent fiber, 4 percent rubbed; moderate fine subangular blocky structure; friable; light yellowish brown (10YR 6/4) sodium pyrophosphate; primarily herbaceous fibers; weak effervescence because of snail shells; mildly alkaline; gradual wavy boundary.

2C—33 to 60 inches; gray (10YR 5/1) marl; massive; friable; common white (10YR 8/1) small snail shells; strong effervescence; moderately alkaline.

The depth to the 2C horizon ranges from 16 to 49 inches. The organic fibers are derived primarily from herbaceous plants. Reaction, tested in 0.01M calcium chloride, ranges from very strongly acid to medium acid throughout the organic material.

The Op horizon is black (N 2/0 or 10YR 2/1) or very dark brown (10YR 2/2). The subsurface and bottom tiers have hue of 5YR, 7.5YR, or 10YR or are neutral in hue. They have value of 2 or 3 and chroma of 0 to 3. The 2C horizon has value of 5 to 8 and chroma of 1 or 2. In some pedons the marl is underlain by less than 12 inches of sandy material within a depth of 51 inches.

Gilford Series

The Gilford series consists of deep, very poorly drained soils on outwash plains and lake plains. These soils formed in loamy and sandy glacial outwash and lacustrine sediments. In most areas they are moderately rapidly permeable in the upper part and rapidly permeable in the underlying material. The loamy substratum phase, however, is moderately rapidly permeable in the upper part and moderately slowly permeable in the underlying material. Slopes range from 0 to 2 percent.

Gilford soils are similar to Barry, Cohoctah, and Sebewa soils and are adjacent to Brady and Branch soils. Barry soils are loamy in the upper part. Cohoctah soils decrease irregularly in content of organic matter as depth increases. Sebewa soils have more clay in the upper part of the solum than the Gilford soils. The somewhat poorly drained Brady and moderately well drained Branch soils are in the slightly higher areas. Their subsoil is browner than that of the Gilford soils and has grayish mottles. Also, the subsoil of Branch soils has less clay.

Typical pedon of Gilford fine sandy loam, in a cultivated field; 1,100 feet east and 2,440 feet north of the southwest corner of sec. 33, T. 30 N., R. 2 E.

Ap—0 to 10 inches; black (10YR 2/1) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine and medium granular structure; friable; many fine and medium roots; medium acid; abrupt smooth boundary.

Bg1—10 to 16 inches; dark grayish brown (2.5Y 4/2) sandy clay loam, grayish brown (10YR 5/2) dry; common medium distinct dark yellowish brown (10YR 4/6) mottles; moderate fine and medium subangular blocky structure; firm; common fine roots; about 1 percent fine gravel; slightly acid; clear wavy boundary.

Bg2—16 to 24 inches; grayish brown (10YR 5/2) sandy loam; common fine distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable; few fine roots; about 2 percent gravel; neutral; clear wavy boundary.

Bg3—24 to 29 inches; grayish brown (10YR 5/2) loamy sand; weak coarse subangular blocky structure; very friable; neutral; clear wavy boundary.

2Cg—29 to 60 inches; light brownish gray (10YR 6/2) coarse sand; single grain; loose; strong effervescence; moderately alkaline.

The solum ranges from 20 to 35 inches in thickness. It is medium acid to neutral. The thickness of the mollic epipedon ranges from 10 to 22 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is fine sandy loam, sandy loam, or loam. The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is sandy loam, loam, or sandy clay loam in the upper part and sandy loam or loamy sand in the lower part. The 2C horizon has value of 4 to 7 and chroma of 1 to 3. It is loamy sand, sand, coarse sand, or gravelly coarse sand. The loamy substratum phase is underlain by gravelly coarse sandy loam, silt loam, or loam.

Homer Series

The Homer series consists of deep, somewhat poorly drained soils on outwash plains, terraces, and valley trains. These soils are moderately permeable in the solum and very rapidly permeable in the underlying material. They formed in outwash sediments. Slopes range from 0 to 2 percent.

Homer soils are similar to Crosier and Markton soils and are adjacent to Kosciusko and Sebewa soils. Crosier and Markton soils have more clay in the underlying material than the Homer soils. Kosciusko soils are well drained and are in the higher lying areas. They are brownish throughout and do not have mottles. Sebewa soils are very poorly drained and are in the lower lying swales and drainageways. They have a surface layer that is thicker and darker than that of the Homer soils and are dominantly gray or dark gray throughout the solum.

Typical pedon of Homer fine sandy loam, 0 to 2 percent slopes, in a cultivated field; 1,640 feet north and 2,120 feet west of the southeast corner of sec. 2, T. 29 N., R. 2 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; about 2 percent fine gravel; slightly acid; abrupt smooth boundary.

E—8 to 16 inches; brown (10YR 5/3) fine sandy loam; common fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; common medium very dark brown (10YR 2/2) worm casts; about 2 percent fine gravel; neutral; clear wavy boundary.

Bt—16 to 22 inches; dark brown (10YR 4/3) sandy clay loam; common fine faint dark grayish brown (10YR 4/2) and common fine distinct dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 10 percent fine gravel; neutral; clear wavy boundary.

2Btg—22 to 30 inches; dark grayish brown (10YR 4/2) gravelly sandy clay loam; common fine distinct dark yellowish brown (10YR 4/6) mottles; weak coarse subangular blocky structure; firm; thick continuous dark grayish brown (10YR 4/2) clay films around pebbles; clay bridges between sand grains; about 25 percent fine gravel; neutral; clear wavy boundary.

2BC—30 to 35 inches; dark brown (10YR 4/3) gravelly coarse sandy loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; about 18 percent fine gravel; neutral; abrupt wavy boundary.

3C—35 to 60 inches; brown (10YR 5/3) gravelly loamy coarse sand; single grain; loose; about 20 percent gravel; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loam and sandy loam. This horizon is neutral to medium acid. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The content of gravel in this horizon ranges from 1 to 15 percent. The 2Bt horizon has value of 4 or 5 and chroma of 2 to 4. It is slightly acid or neutral. The 3C horizon has value of 4 or 5 and chroma of 1 to 4. It is gravelly loamy coarse sand, gravelly coarse sand, or very gravelly coarse sand.

Houghton Series

The Houghton series consists of deep, very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in bogs on lake plains, outwash plains, till plains, and moraines. These soils formed in deep deposits of organic material. Slopes range from 0 to 2 percent.

Houghton soils are similar to Adrian, Edwards, and Muskego soils and are adjacent to the Wallkill soils. Adrian soils are underlain by sandy material, Edwards soils by marl, and Muskego soils by coprogenous earth. Wallkill soils are loam, silt loam, or fine sandy loam in the upper 16 to 40 inches and are underlain by muck.

Typical pedon of Houghton muck, drained, in a cultivated field; 1,600 feet north and 360 feet west of the southeast corner of sec. 16, T. 30 N., R. 2 E.

Op—0 to 9 inches; sapric material, black (N 2/0) broken face and rubbed; less than 5 percent fiber, a trace rubbed; moderate medium granular structure; friable; very dark brown (10YR 2/2) sodium pyrophosphate; primarily herbaceous fibers; medium acid; abrupt smooth boundary.

Oa1—9 to 15 inches; sapric material, black (N 2/0) broken face and rubbed; less than 5 percent fiber, a trace rubbed; moderate medium granular structure; friable; very pale brown (10YR 7/4) sodium pyrophosphate; primarily herbaceous fibers; medium acid; clear wavy boundary.

Oa2—15 to 50 inches; sapric material, very dark brown (10YR 2/2) broken face, black (10YR 2/1) rubbed; about 5 percent fiber, a trace rubbed; moderate medium subangular blocky structure; friable; very pale brown (10YR 7/4) sodium pyrophosphate; primarily herbaceous fibers; strongly acid; clear wavy boundary.

Oa3—50 to 80 inches; sapric material, dark brown (7.5YR 3/2) broken face and rubbed; about 10 percent fiber, 2 percent rubbed; massive; friable; pale brown (10YR 6/3) sodium pyrophosphate; primarily herbaceous fibers; strongly acid.

The organic material is more than 51 inches thick. It is primarily herbaceous. The control section has hue of 10YR, 7.5YR, or 5YR or is neutral in hue. It has value of 2 or 3 and chroma of 1 to 3. Broken faces become darker when exposured to air. Reaction, tested in 0.01M calcium chloride, is strongly acid to slightly acid in the subsurface tier.

Kosciusko Series

The Kosciusko series consists of deep, well drained soils on outwash plains and terraces. These soils are moderately permeable in the solum and very rapidly permeable in the underlying material. They formed in glacial outwash. Slopes range from 0 to 12 percent.

Kosciusko soils are similar to Ormas and Wawasee soils and are adjacent to Ormas, Homer, and Sebewa soils. Ormas soils have more sand and less clay throughout the solum than the Kosciusko soils. Wawasee soils have more clay in the underlying material than the Kosciusko soils. Homer soils are somewhat poorly drained and are in the lower lying areas. They have grayish mottles in the upper part of the solum. Sebewa soils are very poorly drained and are in depressional areas. They have a surface layer that is thicker and darker than that of the Kosciusko soils.

Typical pedon of Kosciusko fine sandy loam, in a cultivated area of Kosciusko-Ormas complex, 0 to 2 percent slopes; 100 feet north and 250 feet east of the southwest corner of sec. 14, T. 30 N., R. 4 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; friable; common fine roots; about 2 percent fine gravel; medium acid; abrupt smooth boundary.

E—9 to 14 inches; brown (10YR 5/3) loamy sand; weak thick platy structure; very friable; common fine roots; about 5 percent fine gravel; slightly acid; clear wavy boundary.

Bt1—14 to 22 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate fine subangular blocky structure; firm; few fine roots; thin discontinuous dark yellowish brown (10YR 3/4) clay films on faces of peds and clay bridges between sand grains; about 10 percent fine gravel; slightly acid; clear wavy boundary.

Bt2—22 to 28 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few fine roots; clay bridges between sand grains; about 14 percent fine gravel; neutral; clear wavy boundary.

Bt3—28 to 31 inches; dark brown (10YR 4/3) gravelly sandy clay loam; weak coarse subangular blocky structure; firm; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds and clay bridges between sand grains; about 20 percent fine gravel and 2 percent coarse gravel; neutral; abrupt wavy boundary.

2C—31 to 60 inches; pale brown (10YR 6/3) very gravelly coarse sand; single grain; loose; about 50 percent gravel; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness. The Ap horizon has value of 3 or 4 (6 or 7 dry) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is slightly acid or neutral. The content of gravel in this horizon ranges from 5 to 30 percent. The C horizon has value of 5 or 6 and chroma of 3 or 4.

Markton Series

The Markton series consists of deep, somewhat poorly drained soils on lake plains and till plains. These soils are rapidly permeable in the upper part of the solum and moderately permeable in the lower part and in the underlying material. They formed in sandy glaciofluvial material and in the underlying loamy till. Slopes range from 0 to 2 percent.

Markton soils are similar to Brady, Crosier, and Homer soils and are adjacent to Chelsea, Gilford, Metea, and Wawasee soils. Brady, Crosier, Gilford, and Homer soils have more clay in the upper part than the Markton soils. Also, Brady and Homer soils have more sand and less clay in the underlying material. Gilford soils are very poorly drained and are in depressions. Chelsea soils are excessively drained, have more sand throughout than

the Markton soils, and are browner. Metea soils are well drained and are in the slightly higher areas. They are browner than the Markton soils. Wawasee soils are well drained, have less sand and more clay in the upper part of the solum than the Markton soils, and are browner.

Typical pedon of Markton loamy sand, 0 to 2 percent slopes, in a cultivated field; 180 feet west and 2,220 feet north of the southeast corner of sec. 28, T. 30 N., R. 1 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; about 2 percent fine gravel; slightly acid; abrupt smooth boundary.

Bw1—10 to 15 inches; yellowish brown (10YR 5/4) fine sand; common fine faint dark yellowish brown (10YR 4/6) mottles; single grain; loose; common fine roots; about 2 percent fine gravel; neutral; clear wavy boundary.

Bw2—15 to 26 inches; yellowish brown (10YR 5/6) fine sand; common medium distinct strong brown (7.5YR 5/8) mottles; single grain; loose; few fine roots; about 2 percent gravel; neutral; clear wavy boundary.

Bt1—26 to 32 inches; dark brown (10YR 4/3) loamy sand; common medium distinct dark yellowish brown (10YR 4/6) and few fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; clay bridging between sand grains; about 5 percent fine and medium gravel; neutral; clear wavy boundary.

Bt2—32 to 34 inches; dark brown (10YR 4/3) sandy loam; common medium distinct dark yellowish brown (10YR 4/6) and few fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 5 percent fine and medium gravel; neutral; clear wavy boundary.

2Bt3—34 to 38 inches; grayish brown (10YR 5/2) fine sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 5 percent fine gravel; slight effervescence; mildly alkaline; clear wavy boundary.

2C—38 to 60 inches; brown (10YR 5/3) loam; common medium distinct gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; massive; friable; about 5 percent fine gravel; strong effervescence; moderately alkaline.

The solum is 28 to 40 inches thick. It ranges from medium acid to neutral in the upper part and from slightly acid to mildly alkaline in the lower part.

The Ap horizon has chroma of 1 or 2. It is dominantly loamy sand, but the range includes sand. The Bw horizon has value of 4 or 5 and chroma of 3 to 6. It is sand, fine sand, or loamy sand. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is sand, fine sand, loamy sand, or sandy loam. The 2Bt horizon has chroma of 1 to 3. It is sandy loam, fine sandy loam, or loam. The 2C horizon has value of 5 or 6 and chroma of 2 or 3.

Metea Series

The Metea series consists of deep, well drained soils on glacial moraines and till plains. These soils are rapidly permeable in the upper part and moderately permeable in the lower part. They formed in water- or wind-deposited sandy material over loamy till. Slopes range from 0 to 12 percent.

Metea soils are similar to Ormas soils and are adjacent to Markton soils. Ormas soils have less clay in the subsoil than the Metea soils and are sandy in the underlying material. Markton soils are somewhat poorly drained and are in the lower lying, nearly level areas. They have grayish mottles in the upper part of the solum.

Typical pedon of Metea loamy sand, 2 to 6 percent slopes, in a cultivated field; 1,200 feet west and 200 feet south of the center of sec. 16, T. 29 N., R. 1 E.

Ap—0 to 10 inches; dark brown (10YR 4/3) loamy sand, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; slightly acid; abrupt smooth boundary.

E1—10 to 17 inches; yellowish brown (10YR 5/4) loamy sand; weak very fine granular structure; very friable; medium acid; clear wavy boundary.

E2—17 to 25 inches; yellowish brown (10YR 5/4) loamy sand; weak very fine granular structure; very friable; slightly acid; clear wavy boundary.

Bt1—25 to 30 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine subangular blocky structure; friable; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; about 2 percent fine gravel; slightly acid; clear wavy boundary.

2Bt2—30 to 40 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; firm; thin continuous dark brown (10YR 4/3) clay films on faces of peds; about 2 percent fine gravel; slightly acid; clear wavy boundary.

2C1—40 to 49 inches; pale brown (10YR 6/3) loam; massive; friable; common fine distinct light gray (10YR 6/1) accumulations of carbonate; about 5 percent fine gravel; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—49 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; few fine prominent very pale brown (10YR 7/3) accumulations of carbonate; about 5 percent fine gravel; violent effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The thickness of the sandy upper horizons is 20 to 40 inches.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is dominantly loamy sand, but the range includes loamy fine sand and sand. This horizon is medium acid to neutral. The E and Bt horizons have value of 4 to 6 and chroma of 3 to 5. The E horizon is loamy sand, loamy fine sand, or sand. It is medium acid to neutral. The Bt horizon is medium acid or slightly acid. The 2Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is clay loam or loam. It is slightly acid or neutral. The 2C horizon has value of 5 or 6 and chroma of 3 to 8.

Morley Series

The Morley series consists of deep, well drained or moderately well drained, moderately slowly permeable or slowly permeable soils on till plains and moraines. These soils formed in glacial till. Slopes range from 2 to 12 percent.

Morley soils are adjacent to Blount and Pewamo soils. Blount soils are somewhat poorly drained and are in plane or slightly convex areas. They have grayish mottles in the upper part of the subsoil. Pewamo soils are very poorly drained and are in depressional areas. They have a surface layer that is thicker and darker than that of the Morley soils.

Typical pedon of Morley loam, 2 to 6 percent slopes, eroded, in a cultivated field; 1,760 feet east and 2,060 feet north of the southwest corner of sec. 32, T. 30 N., R. 5 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; specks and lumps of dark yellowish brown (10YR 4/4) clay loam; moderate medium granular structure; friable; about 1 percent gravel; neutral; abrupt smooth boundary.

Bt1—9 to 14 inches; dark yellowish brown (10YR 4/4) clay; moderate fine and medium subangular blocky structure; firm; thin continuous yellowish brown (10YR 5/4) clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—14 to 18 inches; dark yellowish brown (10YR 4/6) clay; moderate medium subangular blocky structure; firm; thick continuous dark brown (10YR 4/3) clay films on faces of peds; neutral; clear wavy boundary.

Bt3—18 to 23 inches; yellowish brown (10YR 5/4) clay loam; moderate medium subangular blocky structure; firm; thick continuous brown (10YR 5/3) clay films on faces of peds; about 1 percent fine gravel; slight effervescence; mildly alkaline; clear wavy boundary.

Bt4—23 to 27 inches; yellowish brown (10YR 5/4) clay loam; moderate coarse subangular blocky structure; firm; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; about 2 percent fine gravel; strong effervescence; moderately alkaline; clear wavy boundary.

Bt5—27 to 39 inches; brown (10YR 5/3) clay loam; moderate coarse subangular blocky structure; firm; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; common fine very pale brown (10YR 7/3) accumulations of calcium carbonate; about 3 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C—39 to 60 inches; brown (10YR 5/3) clay loam; massive; firm; about 3 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 22 to 45 inches. The Ap horizon has chroma of 1 or 2. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. The C horizon has value of 5 or 6 and chroma of 2 to 6.

Morocco Series

The Morocco series consists of deep, somewhat poorly drained, rapidly permeable soils on outwash plains. These soils formed in acid, sandy material. Slopes range from 0 to 2 percent.

Morocco soils are adjacent to Brems and Newton soils. Brems soils are moderately well drained and are in the slightly higher areas. They are browner than the Morocco soils. Newton soils are very poorly drained and are in the lower areas. They have a surface layer that is thicker and darker than that of the Morocco soils.

Typical pedon of Morocco loamy sand, in a cultivated field; 2,300 feet west and 300 feet south of the northeast corner of sec. 14, T. 31 N., R. 1 E.

Ap—0 to 10 inches; dark yellowish brown (10YR 3/4) loamy sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; medium acid; abrupt smooth boundary.

Bw1—10 to 20 inches; brown (10YR 5/3) sand; few fine faint light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; single grain; loose; about 1 percent fine gravel; strongly acid; clear wavy boundary.

Bw2—20 to 28 inches; brown (10YR 5/3) sand; few fine faint grayish brown (10YR 5/2) and many medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; about 5 percent fine gravel; very strongly acid; clear wavy boundary.

Bw3—28 to 38 inches; yellowish brown (10YR 5/6) sand; many medium distinct light brownish gray (10YR 6/2) mottles; single grain; loose; about 1 percent fine gravel; very strongly acid; clear wavy boundary.

C1—38 to 48 inches; brownish yellow (10YR 6/6) sand; few medium faint yellowish brown (10YR 5/6) and few medium distinct light brownish gray (10YR 6/2)

mottles; single grain; loose; about 1 percent fine gravel; very strongly acid; clear wavy boundary.

C2—48 to 60 inches; light yellowish brown (10YR 6/4) sand; common medium prominent brown (7.5YR 5/2) and common fine faint light brownish gray (10YR 6/2) mottles; single grain; loose; about 1 percent fine gravel; very strongly acid.

The solum ranges from 24 to 48 inches in thickness. The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is dominantly loamy sand, but the range includes loamy fine sand, fine sand, and sand. This horizon is slightly acid to strongly acid. The Bw horizon has value of 5 to 7 and chroma of 1 to 8. It is loamy fine sand, fine sand, loamy sand, or sand. The C horizon has value of 5 to 8 and chroma of 1 to 6. It is fine sand or sand. It is medium acid to very strongly acid.

Muskego Series

The Muskego series consists of deep, very poorly drained soils that formed in organic deposits over coprogenous earth. These soils are moderately permeable or moderately rapidly permeable in the organic material and slowly permeable in the coprogenous earth. They are in old glacial lake basins on lake plains, outwash plains, till plains, and moraines. Slopes range from 0 to 2 percent.

Muskego soils are similar to Adrian, Edwards, and Houghton soils and are adjacent to Sebewa soils. Adrian soils have organic material that is 16 to 50 inches deep over sandy material. Edwards soils have organic material that is 16 to 50 inches deep over marl. Houghton soils have organic material that is more than 51 inches thick. Sebewa soils do not have layers of muck or coprogenous earth.

Typical pedon of Muskego muck, drained, in a cultivated field; Michigan Road Land; 450 feet south and 720 feet east of the northwest corner of sec. 42, T. 29 N., R. 2 E.

Op—0 to 8 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 68 percent fiber, 5 percent rubbed; moderate fine granular structure; friable; many fine roots; very dark grayish brown (10YR 3/2) sodium pyrophosphate; primarily herbaceous fibers; very strongly acid; abrupt smooth boundary.

Oa—8 to 20 inches; sapric material, very dark brown (10YR 2/2) broken face and rubbed; about 60 percent fiber, 6 percent rubbed; moderate thick platy structure; friable; common fine roots; light yellowish brown (10YR 6/4) sodium pyrophosphate; primarily herbaceous fibers; strongly acid; clear wavy boundary.

C1—20 to 29 inches; very dark grayish brown (10YR 3/2) coprogenous earth; moderate thin platy structure; slightly plastic, friable; few fine roots; light yellowish brown (10YR 6/4) sodium pyrophosphate; neutral; clear wavy boundary.

C2—29 to 55 inches; dark olive gray (5Y 3/2) coprogenous earth; massive; slightly plastic, firm; common fine dark yellowish brown (10YR 3/6) plant remains; neutral; clear wavy boundary.

C3—55 to 60 inches; dark gray (10YR 4/1) coprogenous earth; massive; slightly plastic, firm; strong effervescence; moderately alkaline.

The depth to coprogenous earth generally ranges from 16 to 30 inches but is as much as 50 inches in some pedons. The fiber is derived primarily from herbaceous plants.

The Op horizon is black (10YR 2/1) or very dark brown (10YR 2/2) sapric material. The Oa horizon is black (N 2/0, 10YR 2/1, or 7.5YR 2/1) or very dark gray (N 3/0, 10YR 3/1, or 7.5YR 3/1) or has hue of 10YR, 7.5YR, or 5YR and value and chroma of 2 or 3. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 5, and chroma of 1 to 3.

Newton Series

The Newton series consists of deep, very poorly drained, rapidly permeable soils on outwash plains and lake plains. These soils formed in sandy material. Slopes range from 0 to 2 percent.

Newton soils are adjacent to the moderately well drained Brems and excessively drained Plainfield soils. The adjacent soils are browner than the Newton soils. They are in the higher positions on the landscape.

Typical pedon of Newton fine sandy loam, in a cultivated field; 1,780 feet north and 250 feet east of the southwest corner of sec. 11, T. 31 N., R. 1 E.

Ap—0 to 10 inches; black (N 2/0) fine sandy loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; very friable; slightly acid; abrupt smooth boundary.

A—10 to 18 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; few fine prominent dark yellowish brown (10YR 4/6) mottles; weak fine granular structure; very friable; medium acid; clear irregular boundary.

Cg1—18 to 28 inches; light brownish gray (2.5Y 6/2) fine sand; common fine prominent dark yellowish brown (10YR 4/6) mottles; single grain; loose; very strongly acid; clear wavy boundary.

Cg2—28 to 38 inches; grayish brown (2.5Y 5/2) sand; common fine distinct light yellowish brown (10YR 6/4) mottles; single grain; loose; very strongly acid; clear wavy boundary.

Cg3—38 to 48 inches; light brownish gray (2.5Y 6/2) sand; common fine distinct light yellowish brown (10YR 6/4) mottles; single grain; loose; very strongly acid; clear wavy boundary.

Cg4—48 to 60 inches; grayish brown (10YR 5/2) sand; common medium distinct yellowish brown (10YR 5/4) mottles; single grain; loose; about 10 percent gravel; strongly acid.

The A horizon is black (N 2/0) or has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loamy fine sand and loamy sand. The Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is sand, loamy fine sand, or fine sand. It is very strongly acid to medium acid.

Ormas Series

The Ormas series consists of deep, well drained soils on outwash plains and terraces. The soils are rapidly permeable in the upper part of the solum and moderately rapidly permeable in the lower part. They are very rapidly permeable in the underlying material. They formed in material reworked by the wind. Slopes range from 0 to 12 percent.

Ormas soils are similar to Chelsea, Kosciusko, and Metea soils and are adjacent to Brady, Branch, Gilford, and Kosciusko soils. Chelsea soils have more sand throughout the solum than the Ormas soils. Kosciusko soils have more clay in the upper part of the subsoil than the Ormas soils. Metea soils have more clay in the underlying material than the Ormas soils. Brady soils are somewhat poorly drained and are on the lower lying flats. They have mottles directly below the plow layer. Branch soils are moderately well drained and are in the slightly lower areas. They have grayish mottles in the upper part of the argillic horizon. Gilford soils are very poorly drained and are on low lying flats and in drainageways. They have a surface layer that is thicker and darker than that of the Ormas soils.

Typical pedon of Ormas loamy sand, 2 to 6 percent slopes, in a cultivated field; 220 feet north and 2,350 feet west of the southeast corner of sec. 4, T. 29 N., R. 2 E.

Ap—0 to 10 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; medium acid; abrupt smooth boundary.

E1—10 to 16 inches; yellowish brown (10YR 5/6) sand; single grain; loose; neutral; gradual wavy boundary.

E2—16 to 37 inches; brownish yellow (10YR 6/6) fine sand; single grain; loose; neutral; clear wavy boundary.

Bt1—37 to 45 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; clay bridges between sand grains; about 1 percent gravel; slightly acid; clear wavy boundary.

Bt2—45 to 51 inches; dark yellowish brown (10YR 4/4) fine sandy loam; moderate fine and medium subangular blocky structure; friable; clay bridges between sand grains; about 2 percent gravel; slightly acid; clear wavy boundary.

BC—51 to 56 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine granular structure; friable; about 2 percent gravel; neutral; clear wavy boundary.

2C—56 to 60 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; about 20 percent gravel; strong effervescence; moderately alkaline.

The solum is 45 to 75 inches thick. The Ap horizon has value of 3 to 5 and chroma of 2 or 3. It is dominantly loamy sand, but the range includes loamy fine sand and sand. This horizon is medium acid to neutral. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 8. It is fine sandy loam, sandy loam, sandy clay loam, gravelly sandy loam, or gravelly sandy clay loam. It is strongly acid to slightly acid.

Pewamo Series

The Pewamo series consists of deep, very poorly drained, moderately slowly permeable soils in depressional areas on moraines. These soils formed in glacial till. Slopes range from 0 to 2 percent.

Pewamo soils are adjacent to Blount and Morley soils. Blount soils are browner than the Pewamo soils. They are somewhat poorly drained and are in the slightly higher areas. Morley soils have a brownish subsoil. They are well drained and moderately well drained and are in the higher areas.

Typical pedon of Pewamo clay loam, in a cultivated field; 1,860 feet west and 1,250 feet north of the southeast corner of sec. 32, T. 30 N., R. 5 E.

Ap—0 to 9 inches; very dark brown (10YR 2/2) clay loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Btg1—9 to 17 inches; dark gray (10YR 4/1) clay; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin continuous black (10YR 2/1) clay films on faces of peds; neutral; clear wavy boundary.

Btg2—17 to 26 inches; grayish brown (10YR 5/2) clay; common medium distinct yellowish brown (10YR 5/4) mottles; moderate coarse subangular blocky structure parting to strong medium subangular blocky; firm; medium continuous gray (10YR 5/1) clay films on faces of peds; about 1 percent fine gravel; neutral; clear wavy boundary.

Btg3—26 to 36 inches; gray (10YR 6/1) clay; many medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; thick continuous gray (10YR 5/1) clay films on faces

of peds; about 1 percent fine gravel; neutral; clear wavy boundary.

Cg—36 to 60 inches; gray (10YR 6/1) silty clay; many medium distinct dark yellowish brown (10YR 4/6) mottles; massive; firm; about 1 percent fine gravel; common light gray (10YR 7/2) streaks of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 48 inches. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is slightly acid or neutral. The Bt horizon has value of 4 to 6 and chroma of 1 or 2. The C horizon is clay loam or silty clay.

Plainfield Series

The Plainfield series consists of deep, excessively drained, rapidly permeable soils on outwash plains and uplands. These soils formed in sandy outwash and windblown sandy material. Slopes range from 0 to 12 percent.

Plainfield soils are adjacent to Brems, Morocco, and Newton soils. Brems soils are moderately well drained and are in the lower, more nearly level areas. They have gray mottles in the lower part of the solum. Morocco soils have grayish mottles directly below the plow layer. They are in the lower, more nearly level areas. Newton soils are very poorly drained and are on broad flats and in drainageways. They have a surface layer that is thicker and darker than that of the Plainfield soils.

Typical pedon of Plainfield sand, 2 to 6 percent slopes, in a wooded area; 1,000 feet east and 2,450 feet north of the southwest corner of sec. 32, T. 30 N., R. 1 E.

A—0 to 4 inches; very dark brown (10YR 2/2) sand, very dark grayish brown (10YR 3/2) dry; single grain; loose; slightly acid; clear wavy boundary.

Bw—4 to 25 inches; dark yellowish brown (10YR 4/6) sand; single grain; loose; strongly acid; clear wavy boundary.

C—25 to 60 inches; yellowish brown (10YR 5/8) sand; single grain; loose; medium acid.

The solum is 20 to 30 inches thick. Reaction ranges from strongly acid to neutral in the A and B horizons and from very strongly acid to slightly acid in the C horizon.

The A horizon has value of 2 or 3 and chroma of 1 to 3. It is sand or loamy sand. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 4 to 8.

Riddles Series

The Riddles series consists of deep, well drained, moderately permeable soils on till plains and moraines. These soils formed in glacial till. Slopes range from 0 to 12 percent.

Riddles soils are similar to Wawasee soils and are adjacent to Barry, Crosier, and Metea soils. Wawasee soils have a solum that is less than 40 inches thick. Barry soils are poorly drained and are in depressional areas. They have a surface layer that is thicker and darker than that of the Riddles soils. Crosier soils are somewhat poorly drained and are in the lower, nearly level areas. They have a mottled subsoil and have a solum that is less than 40 inches thick. Metea soils have more sand in the upper part than the Riddles soils. They are in landscape positions similar to those of the Riddles soils.

Typical pedon of Riddles fine sandy loam, 2 to 6 percent slopes, eroded, in a cultivated field; 60 feet west and 1,480 feet south of the northeast corner of sec. 8, T. 31 N., R. 3 E.

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; specks and lumps of yellowish brown (10YR 5/4) loam; weak medium granular structure; friable; many fine and medium roots; about 2 percent fine gravel; slightly acid; abrupt smooth boundary.

BA—11 to 14 inches; yellowish brown (10YR 5/4) sandy clay loam; weak thick platy structure parting to moderate fine subangular blocky; firm; many medium roots; about 2 percent fine gravel; strongly acid; clear wavy boundary.

Bt1—14 to 21 inches; dark yellowish brown (10YR 4/6) sandy clay loam; moderate fine subangular blocky structure; firm; common medium roots; thin patchy brown (10YR 4/3) clay films on faces of peds; about 5 percent fine gravel; very strongly acid; clear wavy boundary.

Bt2—21 to 29 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; few medium roots; thin discontinuous brown (10YR 4/3) clay films on faces of peds; about 5 percent fine gravel; very strongly acid; clear wavy boundary.

Bt3—29 to 35 inches; yellowish brown (10YR 5/4) sandy clay loam; weak medium subangular blocky structure; firm; few fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent fine gravel; strongly acid; clear wavy boundary.

BC—35 to 46 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium and coarse subangular blocky structure; friable; about 6 percent fine gravel; neutral; clear wavy boundary.

C—46 to 60 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; friable; about 8 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 70 inches thick. The Ap horizon has chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loam and sandy loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam, sandy clay loam, loam, fine sandy loam, or sandy loam. The C horizon has value of 5 or 6 and chroma of 3 or 4. It is loam or fine sandy loam. It is neutral to moderately alkaline.

Sebewa Series

The Sebewa series consists of deep, very poorly drained soils on outwash plains and terraces. These soils are moderately permeable in the solum and rapidly permeable in the underlying material. They formed in loamy and sandy glacial outwash. Slopes range from 0 to 2 percent.

Sebewa soils are similar to Barry and Gilford soils and are adjacent to Brady, Homer, Kosciusko, and Ormas soils. Barry soils have more clay in the underlying material than the Sebewa soils. Gilford soils have less clay throughout the solum than the Sebewa soils. Brady and Homer soils are somewhat poorly drained and are in the higher areas. They are dominantly brownish below the plow layer. Kosciusko and Ormas soils are well drained and are on the higher surrounding slopes and rises. They have a brownish solum.

Typical pedon of Sebewa sandy clay loam, in a cultivated field; 360 feet west and 200 feet south of the northeast corner of sec. 24, T. 30 N., R. 4 E.

Ap—0 to 11 inches; black (10YR 2/1) sandy clay loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

Btg1—11 to 16 inches; dark gray (10YR 4/1) sandy clay loam; common medium distinct light olive brown (2.5Y 5/4) mottles; moderate medium angular blocky structure; firm; common fine roots; thin discontinuous very dark gray (10YR 3/1) clay films on faces of peds; about 2 percent fine gravel; neutral; clear wavy boundary.

Btg2—16 to 22 inches; gray (10YR 6/1) clay loam; many medium prominent light yellowish brown (2.5Y 6/4) mottles; moderate medium and coarse angular blocky structure; firm; few fine roots; thin discontinuous gray (10YR 5/1) clay films on faces of peds; very dark gray (10YR 3/1) root channel fillings; about 2 percent fine gravel; neutral; clear wavy boundary.

Btg3—22 to 30 inches; gray (10YR 5/1) sandy clay loam; many medium prominent light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; firm; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; very dark gray (10YR 3/1) root channel fillings; about 2 percent fine gravel; neutral; abrupt wavy boundary.

2BCg—30 to 34 inches; dark gray (10YR 4/1) gravelly coarse sandy loam; weak coarse subangular blocky structure; friable; about 20 percent fine gravel; strong effervescence; moderately alkaline; clear wavy boundary.

2Cg—34 to 60 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand; single grain; loose; about 35 percent fine gravel; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. It is slightly acid to mildly alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly sandy clay loam, but the range includes loam and sandy loam. The Btg horizon has value of 4 to 6 and chroma of 1 or 2. It is loam, clay loam, or sandy clay loam. The 2Cg horizon has value of 5 or 6 and chroma of 1 or 2.

Wallkill Series

The Wallkill series consists of deep, very poorly drained soils in depressions on uplands and outwash plains. These soils formed in alluvium over organic material. They are moderately permeable in the mineral material and moderately rapidly permeable or rapidly permeable in the organic material. Slopes range from 0 to 2 percent.

These soils have a thicker and darker surface layer and are more acid in the organic material than is definitive for the Wallkill series. These differences, however, do not alter the usefulness or behavior of the soils.

Wallkill soils are similar to Washtenaw soils and are adjacent to Houghton, Riddles, and Wawasee soils. Washtenaw soils do not have a buried organic layer. Houghton soils formed in organic material more than 51 inches thick. Their positions on the landscape are similar to those of the Wallkill soils. Riddles and Wawasee soils are well drained and are on the more sloping uplands. They have a brownish subsoil.

Typical pedon of Wallkill silt loam, in a cultivated field; 1,840 feet east and 2,440 feet south of the northwest corner of sec. 22, T. 29 N., R. 1 E.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; weak fine and medium granular structure; friable; neutral; abrupt smooth boundary.

Bw1—10 to 24 inches; very dark gray (10YR 3/1) silt loam; weak medium subangular blocky structure; friable; slightly acid; clear wavy boundary.

Bw2—24 to 30 inches; very dark gray (10YR 3/1) silt loam; moderate medium subangular blocky structure; friable; neutral; clear wavy boundary.

2Oa1—30 to 45 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 84 percent fiber, 4 percent rubbed; moderate medium

subangular blocky structure; friable; primarily herbaceous fibers; very strongly acid; clear wavy boundary.

2Oa2—45 to 60 inches; sapric material, dark reddish brown (5YR 3/2) broken face, black (10YR 2/1) rubbed; about 60 percent fiber, a trace rubbed; moderate fine subangular blocky structure; friable; primarily herbaceous fibers; very strongly acid.

The mineral material is 16 to 40 inches deep over the organic material. Reaction ranges from medium acid to neutral in the mineral material and from very strongly acid to neutral in the organic material.

The Ap horizon has value of 2 to 4 and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam and fine sandy loam. The Bw horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. It is silt loam, loam, or fine sandy loam. The 2Oa horizon has hue of 5YR, 7.5YR, or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2.

Washtenaw Series

The Washtenaw series consists of deep, very poorly drained soils in nearly level or depressional areas on moraines, till plains, and outwash plains. These soils are moderately permeable in the upper part of the solum and slowly permeable in the lower part and in the underlying material. They formed in alluvium over glacial drift. Slopes range from 0 to 2 percent.

The control section of these soils has less clay than is definitive for the Washtenaw series. Also, it does not have mottles in the upper 20 inches. These differences, however, do not alter the usefulness or behavior of the soils.

Washtenaw soils are similar to Wallkill soils and are adjacent to Metea, Riddles, and Wawasee soils. Wallkill soils have a buried organic layer. The well drained Metea, Riddles, and Wawasee soils are on the higher, more sloping uplands. They are browner in the subsoil than the Washtenaw soils.

Typical pedon of Washtenaw silt loam, in a cultivated field; 575 feet west and 110 feet south of the northeast corner of sec. 17, T. 31 N., R. 3 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; friable; about 1 percent fine gravel; medium acid; abrupt smooth boundary.

C—10 to 23 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; friable; about 1 percent fine gravel; medium acid; clear wavy boundary.

2Ab1—23 to 28 inches; black (10YR 2/1) fine sandy loam; weak fine granular structure; friable; about 3 percent fine gravel; slightly acid; clear wavy boundary.

2Ab2—28 to 34 inches; very dark gray (10YR 3/1) fine sandy loam; common medium faint grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable; about 3 percent fine gravel; slightly acid; clear wavy boundary.

2Btgb—34 to 50 inches; gray (10YR 5/1) loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 5 percent fine gravel; slightly acid; clear wavy boundary.

2Cg—50 to 60 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct yellowish brown (10YR 5/4) mottles; massive; friable; about 10 percent fine gravel; neutral.

The overwash is 20 to 40 inches thick. The solum is medium acid to neutral.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam and sandy loam. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2, or it is neutral in hue and has value of 4 to 6. It is loam, sandy loam, or silt loam. The 2Ab horizon has value of 2 or 3 and chroma of 1 or 2. It is loam, silt loam, or fine sandy loam. The 2Btgb horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 2, or it is neutral in hue and has value of 4 to 6. It is clay loam, silty clay loam, loam, or silt loam. The 2C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is loam, silt loam, or sandy clay loam.

Wawasee Series

The Wawasee series consists of deep, well drained, moderately permeable soils on glacial till plains and moraines. These soils formed in glacial till. Slopes range from 2 to 18 percent.

Wawasee soils are similar to Kosciusko and Riddles soils and are adjacent to Barry, Crosier, and Metea soils. Kosciusko soils are underlain by very gravelly coarse sand. Riddles soils have a solum that is thicker than that of the Wawasee soils. Barry soils are poorly drained and are in depressional areas. They are dominantly grayish and have a surface layer that is thicker and darker than that of the Wawasee soils. Crosier soils are somewhat poorly drained and are in the lower areas. They have grayish mottles in the upper part of the solum. Metea soils have a sandy surface layer. They are in landscape positions similar to those of the Wawasee soils.

Typical pedon of Wawasee fine sandy loam, 2 to 6 percent slopes, in a cultivated field; 960 feet east and 80 feet north of the southwest corner of sec. 3, T. 31 N., R. 3 E.

Ap—0 to 10 inches; dark brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; about 2 percent fine gravel; medium acid; abrupt smooth boundary.

Bt1—10 to 21 inches; dark yellowish brown (10YR 4/4) loam; few worm casts of material from the Ap horizon; moderate fine and medium subangular blocky structure; friable; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent gravel; slightly acid; clear wavy boundary.

Bt2—21 to 28 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate fine subangular blocky structure; firm; thin continuous yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent gravel; strongly acid; clear wavy boundary.

Bt3—28 to 39 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; thin discontinuous brown (10YR 4/3) clay films on faces of peds; about 5 percent gravel; medium acid; clear wavy boundary.

C—39 to 60 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; friable; about 5 percent gravel; common discontinuous grayish brown (10YR 5/2) coatings of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 28 to 40 inches. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam and loam. This horizon is medium acid to neutral. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is loam or sandy clay loam. It is strongly acid to neutral. The C horizon has value of 5 or 6 and chroma of 2 to 6. It is fine sandy loam or loam.

Formation of the Soils

This section relates the major factors of soil formation to the soils in the county. It also describes the processes of soil formation.

Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always required for the differentiation of soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The parent materials of the soils in Fulton County probably were deposited by glaciers or by meltwater from the glaciers. Some of these materials were reworked and redeposited by the subsequent actions of water and wind. The glaciers probably covered the county several times. The most recent one retreated about 12,000 to 15,000 years ago. Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Fulton County were deposited as glacial till, outwash, alluvium, and organic material.

Glacial till is material laid down directly by a glacier with a minimum of water action. It consists of particles of different sizes that are mixed together. Some small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Fulton County is calcareous and firm. It is dominantly clay loam or loam. Crosier soils are an example of soils that formed in glacial till. These soils typically have a moderately fine textured subsoil and have well developed structure.

Outwash material was deposited by running water from melting glaciers. The size of the particles that make up outwash varies according to the velocity of the water that carried the material. When the water slowed down, the coarser particles were deposited first. Finer particles, such as very fine sand, silt, and clay, were carried by the more slowly moving water. Outwash deposits generally occur as layers of particles of similar size, such as sand and gravel. Brady soils are an example of soils that formed in outwash material.

Alluvium is material deposited recently by floodwater along present streams. This material ranges in texture, depending on the speed of the water from which it was deposited. The alluvium deposited along a swift stream, such as the Tippecanoe River, is coarser textured than that deposited along a slower, sluggish stream, such as Mud Creek. Cohoctah soils are examples of soils that formed in alluvium.

Organic material is made up of deposits of plant remains. After the glaciers receded from the area, water was left standing in lakes and in depressions on outwash plains and till plains. Grasses and sedges growing around the edges of these lakes died, and their remains fell to the bottom. Because of wetness, the plant remains did not decompose quickly. Later, tamarack and other water-tolerant trees grew in the areas. As these trees died, their remains became a part of the organic accumulation. The lakes were eventually filled with organic material and developed into areas of peat. In most areas the plant remains subsequently decomposed to form muck. In some areas the material has changed little since deposition. Houghton soils are an example of soils that formed in organic material.

Plant and Animal Life

Plants have been the principal organisms influencing the soils in Fulton County. Bacteria, fungi, and

earthworms, however, have also been important. The chief contribution of plant and animal life to soil formation is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kinds of plants that grew on the soil in the past. The remains of these plants accumulated on the surface, decayed, and eventually became organic matter. The roots of the plants provided channels for the downward movement of water through the soil and added organic matter as they decayed. Bacteria helped to break down the organic matter into plant nutrients.

The native vegetation in Fulton County was mainly mixed trees. Differences in natural soil drainage and minor variations in the parent material affected the composition of the forest species. The well drained soils, such as Riddles and Wawasee soils, were covered mainly with oak, beech, hickory, ash, walnut, and sugar maple. The excessively drained Chelsea and Plainfield soils were covered with white pine and scrub oak.

The wet soils were covered mainly with soft maple, ash, elm, swamp white oak, cedar, and tamarack. If they were marshy, they were covered with sedges, rushes, coarse grasses, and similar plants. In a few wet areas, sphagnum and other mosses contributed substantially to the accumulation of organic matter. Gilford and Sebewa soils formed under wet conditions and contain a considerable amount of organic matter. The organic Adrian and Houghton soils also formed under wet conditions. Soils that formed dominantly under forest vegetation generally have less organic matter than soils that formed dominantly under grasses.

Climate

Climate helps to determine the kind of plant and animal life on and in the soil, the amount of water available for the weathering of minerals and the translocation of soil material, and the rate of chemical reaction in the soil.

The climate in Fulton County is cool and humid. It is presumably similar to the climate under which the soils formed. The soils in this county differ from those that formed under a dry, warm climate and from those that formed under a hot, moist climate. Climate is uniform throughout the county, although its effect is modified locally in areas near Lake Manitou. Only minor differences among the soils are the result of differences in climate. More information about the climate is available under the heading "General Nature of the County."

Relief

Relief has markedly affected the soils in Fulton County through its effect on natural drainage, runoff, erosion, plant cover, and soil temperature. Slopes range from 0 to 18 percent. Runoff is most rapid on the steeper slopes. Water is temporarily ponded in low areas.

Natural soil drainage in the county ranges from excessively drained on sandy ridgetops to very poorly drained in depressions. Through its effect on aeration in the soil, drainage determines the color of the soil. Water and air move freely through well drained soils but slowly through very poorly drained soils. In Riddles and other well drained, well aerated soils, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized. Gilford and other poorly aerated, very poorly drained soils are dull gray and mottled.

Time

Usually, a long time is needed for the processes of soil formation to form distinct horizons in the parent material. Differences in the length of time that the parent material has been in place are commonly reflected in the degree of profile development. Some soils form rapidly. Others form slowly.

The soils in Fulton County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to the soil-forming factors long enough for the formation of distinct horizons.

Morley and Riddles are examples of soils that have been forming long enough for lime to be leached from the solum. The parent material of these soils had about the same amount of lime as is currently in the C horizon. Morley soils are leached to a depth of about 22 to 45 inches. On the other hand, Riddles soils are leached to a depth of about 40 to 70 inches. They are leached to a greater depth probably because they are more permeable.

Processes of Soil Formation

Several processes have been involved in the formation of the soils in Fulton County. These processes are the accumulation of organic matter; the dissolution, transfer, and removal of calcium carbonates and bases; the liberation and translocation of silicate clay minerals; and the reduction and transfer of iron. In most soils more than one of these processes have helped to differentiate horizons.

Some organic matter has accumulated in the surface layer of all the soils in the county. The organic matter content of some soils is low, but that of others is high. Generally, the soils that have the most organic matter, such as Gilford and Sebewa soils, have a thick, black surface layer.

Carbonates and bases have been leached from the upper horizons of nearly all the soils in the county. Leaching probably preceded the translocation of silicate clay minerals. Most of the carbonates and some of the bases have been leached from the A and B horizons of well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by an acid reaction. Leaching of wet soils is slow

because of a high water table or the slow movement of water through the profile.

Clay accumulates in pores and other voids and forms films on the surfaces along which water moves. The leaching of bases and the translocation of silicate clay minerals are among the more important processes of horizon differentiation in the county. Morley soils are an example of soils in which translocated silicate clay minerals in the form of clay films have accumulated in the argillic horizon.

Gleying, or the reduction and transfer of iron, has occurred in all of the very poorly drained to somewhat poorly drained soils in the county. In the naturally wet soils, this process has significantly affected horizon differentiation. A gray color in the subsoil indicates the redistribution of iron oxides. Reduction is commonly accompanied by some transfer of iron, either from upper horizons to lower ones or completely out of the profile. Mottles, which are evident in some horizons, indicate the segregation of iron.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The

composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly

continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle

to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing

crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material).

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multipled by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-74 at Rochester, Indiana]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	31.4	14.0	22.7	60	-15	11	1.50	0.37	2.40	4	4.5
February---	35.2	16.4	25.8	60	-10	6	1.73	.97	2.40	4	6.5
March------	45.1	25.8	35.5	77	2	82	2.40	1.49	3.21	7	4.2
April------	59.2	37.3	48.3	84	20	260	4.07	2.38	5.57	8	1.5
May--------	71.5	48.0	59.8	90	29	614	3.69	2.87	4.45	7	.0
June-------	80.9	57.0	69.0	97	40	870	4.43	2.69	5.98	7	.0
July-------	84.3	60.8	72.6	97	45	1,011	4.22	2.75	5.55	7	.0
August-----	82.8	57.7	70.3	96	41	939	3.58	2.09	4.90	6	.0
September--	76.8	50.4	63.6	94	32	708	3.39	1.45	5.03	6	.0
October----	64.7	39.6	52.2	86	22	385	2.82	1.12	4.24	6	.0
November---	48.3	29.3	38.8	73	9	68	2.79	1.78	3.70	6	2.5
December---	36.9	21.0	29.0	62	-6	16	2.40	.59	3.83	5	5.5
Yearly:											
Average--	59.8	38.1	49.0	---	---	---	---	---	---	---	---
Extreme--	---	---	---	100	-17	---	---	---	---	---	---
Total----	---	---	---	---	---	4,970	37.02	28.31	48.63	73	24.7

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at Rochester, Indiana]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 22	May 1	May 19
2 years in 10 later than--	Apr. 17	Apr. 26	May 13
5 years in 10 later than--	Apr. 9	Apr. 17	May 1
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 21	Oct. 3	Sept. 23
2 years in 10 earlier than--	Oct. 25	Oct. 9	Sept. 29
5 years in 10 earlier than--	Nov. 1	Oct. 19	Oct. 9

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-74 at Rochester, Indiana]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	186	162	143
8 years in 10	193	170	149
5 years in 10	206	184	160
2 years in 10	218	199	171
1 year in 10	225	206	177

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ad	Adrian muck, drained	2,550	1.1
Ah	Algansee loamy sand, frequently flooded	1,050	0.5
Bb	Barry loam	28,400	11.9
BlA	Blount loam, 0 to 2 percent slopes	570	0.2
Br	Brady sandy loam	5,100	2.2
BsA	Branch loamy sand, 0 to 2 percent slopes	3,850	1.6
BtA	Brems loamy sand, 0 to 3 percent slopes	1,650	0.7
ChB	Chelsea fine sand, 2 to 6 percent slopes	1,200	0.5
Co	Cohoctah fine sandy loam, occasionally flooded	4,650	2.0
CrA	Crosier loam, 0 to 2 percent slopes	32,130	13.5
Ed	Edwards muck, drained	1,400	0.6
Gf	Gilford fine sandy loam	17,600	7.4
Gh	Gilford fine sandy loam, loamy substratum	2,500	1.1
Hh	Histosols-Aquolls complex, ponded	1,750	0.7
Hk	Homer fine sandy loam, 0 to 2 percent slopes	2,400	1.0
Hm	Houghton muck, drained	9,300	3.9
Ho	Houghton muck, undrained	4,400	1.9
KoA	Kosciusko-Ormas complex, 0 to 2 percent slopes	7,200	3.0
KoB	Kosciusko-Ormas complex, 2 to 6 percent slopes	5,300	2.2
KoC	Kosciusko-Ormas complex, 6 to 12 percent slopes	4,750	2.0
MaA	Markton loamy sand, 0 to 2 percent slopes	9,800	4.1
MeA	Metea loamy sand, 0 to 2 percent slopes	2,350	1.0
MeB	Metea loamy sand, 2 to 6 percent slopes	9,800	4.1
MeC	Metea loamy sand, 6 to 12 percent slopes	1,450	0.6
MrB2	Morley loam, 2 to 6 percent slopes, eroded	2,000	0.8
MsC3	Morley clay loam, 6 to 12 percent slopes, severely eroded	1,500	0.6
Mu	Morocco loamy sand	830	0.4
Mx	Muskego muck, drained	1,900	0.8
Ne	Newton fine sandy loam	2,700	1.1
OmA	Ormas loamy sand, 0 to 2 percent slopes	6,300	2.7
OmB	Ormas loamy sand, 2 to 6 percent slopes	3,450	1.5
Pe	Pewamo clay loam	520	0.2
Pk	Pits, gravel	390	0.2
PlA	Plainfield sand, 0 to 2 percent slopes	1,250	0.5
PlB	Plainfield sand, 2 to 6 percent slopes	1,650	0.7
PlC	Plainfield sand, 6 to 12 percent slopes	1,650	0.7
RlA	Riddles fine sandy loam, 0 to 2 percent slopes	4,050	1.7
RlB2	Riddles fine sandy loam, 2 to 6 percent slopes, eroded	9,600	4.1
RlC2	Riddles fine sandy loam, 6 to 12 percent slopes, eroded	3,350	1.4
Se	Sebewa sandy clay loam	8,500	3.6
Wa	Wallkill silt loam	1,250	0.5
Wh	Washtenaw silt loam	2,200	0.9
WkB	Wawasee fine sandy loam, 2 to 6 percent slopes	16,200	6.8
WkC2	Wawasee fine sandy loam, 6 to 12 percent slopes, eroded	4,500	1.9
WkD	Wawasee fine sandy loam, 12 to 18 percent slopes	560	0.2
	Water less than 40 acres in size	800	0.3
	Water more than 40 acres in size	1,409	0.6
	Total	237,709	100.0

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
Bb	Barry loam (where drained)
BlA	Blount loam, 0 to 2 percent slopes (where drained)
Br	Brady sandy loam (where drained)
BsA	Branch loamy sand, 0 to 2 percent slopes
Co	Cohoctah fine sandy loam, occasionally flooded (where drained)
CrA	Crosier loam, 0 to 2 percent slopes (where drained)
Gf	Gilford fine sandy loam (where drained)
Gh	Gilford fine sandy loam, loamy substratum (where drained)
Hk	Homer fine sandy loam, 0 to 2 percent slopes (where drained)
KoA	Kosciusko-Ormas complex, 0 to 2 percent slopes
KoB	Kosciusko-Ormas complex, 2 to 6 percent slopes
MaA	Markton loamy sand, 0 to 2 percent slopes
MeA	Metea loamy sand, 0 to 2 percent slopes
MeB	Metea loamy sand, 2 to 6 percent slopes
MrB2	Morley loam, 2 to 6 percent slopes, eroded
Ne	Newton fine sandy loam (where drained)
Pe	Pewamo clay loam (where drained)
RlA	Riddles fine sandy loam, 0 to 2 percent slopes
RlB2	Riddles fine sandy loam, 2 to 6 percent slopes, eroded
Se	Sebewa sandy clay loam (where drained)
Wa	Wallkill silt loam (where drained)
Wh	Washtenaw silt loam (where drained)
WkB	Wawasee fine sandy loam, 2 to 6 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Bromegrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
Ad----------------------- Adrian	IVw	75	23	---	---	---
Ah----------------------- Algansee	IIIw	80	26	35	3.5	7.0
Bb----------------------- Barry	IIw	110	35	55	4.8	9.6
BlA---------------------- Blount	IIw	106	35	48	4.3	7.2
Br----------------------- Brady	IIw	105	32	50	4.0	8.0
BsA---------------------- Branch	IIIs	75	28	35	3.0	6.0
BtA---------------------- Brems	IVs	70	24	32	2.3	4.6
ChB---------------------- Chelsea	IVs	68	21	---	2.9	5.8
Co----------------------- Cohoctah	IIw	125	45	60	4.5	9.0
CrA---------------------- Crosier	IIw	120	42	54	4.0	8.0
Ed----------------------- Edwards	IVw	90	34	---	---	---
Gf, Gh------------------- Gilford	IIw	120	42	54	4.0	8.0
Hh----------------------- Histosols-Aquolls	VIIIw	---	---	---	---	---
Hk----------------------- Homer	IIw	95	33	48	3.1	6.2
Hm----------------------- Houghton	IIIw	115	34	---	---	8.0
Ho----------------------- Houghton	Vw	---	---	---	---	---
KoA---------------------- Kosciusko-Ormas	IIIs	77	27	36	2.5	5.0
KoB---------------------- Kosciusko-Ormas	IIIe	70	24	36	2.3	4.7
KoC---------------------- Kosciusko-Ormas	IIIe	65	23	31	2.2	4.4

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Bromegrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
MaA----------------------- Markton	IIIw	100	35	50	3.7	7.4
MeA----------------------- Metea	IIIs	85	30	42	2.8	5.6
MeB----------------------- Metea	IIIe	85	30	42	2.8	5.6
MeC----------------------- Metea	IIIe	75	26	38	2.5	5.0
MrB2---------------------- Morley	IIe	99	34	45	4.1	8.2
MsC3---------------------- Morley	IVe	85	---	39	3.6	7.2
Mu------------------------ Morocco	IVs	80	28	36	2.6	5.2
Mx------------------------ Muskego	IVw	90	35	---	3.0	6.0
Ne------------------------ Newton	IVw	100	35	45	3.3	6.6
OmA----------------------- Ormas	IIIs	70	25	32	2.3	4.6
OmB----------------------- Ormas	IIIs	60	21	30	2.0	4.0
Pe------------------------ Pewamo	IIw	125	42	60	5.0	10.0
Pk**. Pits						
PlA, PlB, PlC------------- Plainfield	VIs	---	---	---	2.0	4.0
RlA----------------------- Riddles	I	120	42	48	4.0	8.0
RlB2---------------------- Riddles	IIe	115	40	46	3.8	7.6
RlC2---------------------- Riddles	IIIe	105	37	42	3.4	6.8
Se------------------------ Sebewa	IIw	105	36	50	4.6	9.2
Wa------------------------ Wallkill	IIIw	100	42	---	3.5	7.0
Wh------------------------ Washtenaw	IIw	130	46	52	4.3	8.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Bromegrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
WkB----------------------- Wawasee	IIe	105	37	47	3.4	6.8
WkC2---------------------- Wawasee	IIIe	90	30	40	3.1	6.0
WkD----------------------- Wawasee	IVe	90	30	40	3.1	6.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	4,050	---	---	---	---
II	132,370	27,800	104,570	---	---
III	73,700	29,150	21,400	23,150	---
IV	14,290	2,060	8,550	3,680	---
V	4,400	---	4,400	---	---
VI	4,550	---	---	4,550	---
VII	---	---	---	---	---
VIII	1,750	---	1,750	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
Ad------------- Adrian	2W	Slight	Severe	Severe	Severe	White ash-----------	51	28	
						Red maple-----------	51	33	
						Quaking aspen-------	56	56	
						Black willow--------	---	---	
						Silver maple--------	76	30	
Ah------------- Algansee	4S	Slight	Slight	Moderate	Slight	Quaking aspen-------	55	53	American sycamore, eastern cottonwood, quaking aspen.
						Silver maple--------	76	30	
						Pin oak-------------	80	62	
						American sycamore---	80	---	
						Hackberry-----------	35	---	
						Red maple-----------	51	33	
						Eastern cottonwood--	90	---	
Bb------------- Barry	5W	Slight	Severe	Severe	Severe	Pin oak-------------	86	68	Eastern white pine, red maple, white ash, American sycamore.
						White oak-----------	75	57	
						Northern red oak----	78	60	
BlA------------ Blount	3C	Slight	Slight	Severe	Severe	White oak-----------	65	48	Eastern white pine, red pine, yellow-poplar.
						Northern red oak----	65	48	
						Green ash-----------	---	---	
						Bur oak-------------	---	---	
						Pin oak-------------	---	---	
Br------------- Brady	5A	Slight	Slight	Slight	Slight	Black oak-----------	90	72	Red pine, green ash, eastern white pine.
						Bur oak-------------	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Green ash-----------	---	---	
						Slippery elm--------	---	---	
BsA------------ Branch	3S	Slight	Slight	Moderate	Slight	Northern red oak----	65	48	Eastern white pine, red pine, Carolina poplar, black walnut.
						White oak-----------	---	---	
						Sugar maple---------	---	---	
						American beech------	---	---	
						American basswood---	---	---	
						Shagbark hickory----	---	---	
						Black walnut--------	---	---	
BtA------------ Brems	4S	Slight	Slight	Moderate	Slight	Northern red oak----	70	52	Eastern white pine, red pine, jack pine.
						Red pine------------	72	128	
						Eastern white pine--	65	136	
						Jack pine-----------	70	107	
ChB------------ Chelsea	3S	Slight	Slight	Moderate	Slight	White oak-----------	55	38	Eastern white pine, European larch, red pine, jack pine.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Management concerns: Equip-ment limita-tion	Management concerns: Seedling mortal-ity	Management concerns: Wind-throw hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
Co-------------- Cohoctah	3W	Slight	Severe	Severe	Severe	Red maple-----------	72	44	Eastern cottonwood, pin oak, green ash, red maple, American sycamore, swamp white oak.
						Silver maple--------	95	46	
						Pin oak------------	---	---	
						Green ash----------	70	75	
						Eastern cottonwood--	---	---	
						Black cherry--------	---	---	
						Swamp white oak-----	---	---	
CrA------------- Crosier	4A	Slight	Slight	Slight	Slight	White oak----------	75	57	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
						Pin oak------------	85	67	
						Yellow-poplar-------	85	81	
						Sweetgum-----------	80	79	
						Northern red oak----	75	57	
Ed-------------- Edwards	2W	Slight	Severe	Severe	Severe	White ash----------	51	28	
						Red maple----------	51	33	
						Quaking aspen-------	56	56	
						Black willow--------	---	---	
						Silver maple--------	76	30	
Gf, Gh---------- Gilford	4W	Slight	Severe	Severe	Severe	Pin oak------------	70	52	Eastern white pine, European larch, white spruce, white ash.
						Eastern white pine--	55	106	
						Bigtooth aspen------	70	81	
						Red maple----------	60	38	
Hk-------------- Homer	4A	Slight	Slight	Slight	Slight	White oak----------	70	52	Eastern white pine, American sycamore, white ash, red maple, yellow-poplar.
						Pin oak------------	85	67	
						Yellow-poplar-------	85	81	
						Sweetgum-----------	80	79	
Hm, Ho---------- Houghton	2W	Slight	Severe	Severe	Severe	White ash----------	51	28	
						Red maple----------	51	33	
						Black willow--------	---	---	
						Quaking aspen-------	56	56	
						Silver maple--------	76	30	
KoA**, KoB**, KoC**:									
Kosciusko-----	4S	Slight	Slight	Moderate	Slight	Northern red oak----	78	60	Eastern white pine, red pine, jack pine.
						White oak----------	76	58	
						Eastern white pine--	70	151	
						Black oak----------	---	---	
						Jack pine----------	---	---	
Ormas---------	4S	Slight	Slight	Moderate	Slight	White oak----------	70	52	Eastern white pine, red pine, yellow-poplar, black walnut, European alder.
						Yellow-poplar-------	---	---	
						Eastern white pine--	---	---	
						Red pine-----------	78	146	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
MaA: Markton	4S	Slight	Slight	Moderate	Slight	White oak	80	62	Eastern white pine, Austrian pine, red pine, black oak, white oak.
						Black oak	70	52	
						Quaking aspen	70	81	
						Eastern cottonwood	90	---	
						Red maple	50	32	
MeA, MeB, MeC: Metea	4S	Slight	Moderate	Moderate	Slight	White oak	80	62	Eastern white pine, red pine, yellow-poplar, black walnut.
						Yellow-poplar	86	82	
						Eastern white pine	75	166	
						Red pine	75	142	
MrB2, MsC3: Morley	4A	Slight	Slight	Slight	Slight	White oak	80	62	White oak, black walnut, green ash, eastern white pine, red pine, white spruce.
						Northern red oak	80	62	
						Yellow-poplar	90	90	
						Black walnut	---	---	
						Bur oak	---	---	
						Shagbark hickory	---	---	
Mu: Morocco	4W	Slight	Slight	Moderate	Slight	Northern red oak	70	52	Eastern white pine, European larch, red maple, American sycamore.
						Pin oak	85	67	
						Eastern white pine	65	136	
Mx: Muskego	2W	Slight	Severe	Severe	Severe	Tamarack	50	42	
						Red maple	51	33	
						White ash	52	30	
						Green ash	---	---	
						Black willow	---	---	
						Quaking aspen	56	56	
						Silver maple	---	---	
Ne: Newton	4W	Slight	Severe	Severe	Severe	Pin oak	70	52	Eastern white pine, European larch.
						Eastern white pine	55	106	
						Eastern cottonwood	70	---	
OmA, OmB: Ormas	4S	Slight	Slight	Moderate	Slight	White oak	70	52	Eastern white pine, red pine, yellow-poplar, black walnut, European alder.
						Yellow-poplar	---	---	
						Eastern white pine	---	---	
						Red pine	78	146	
Pe: Pewamo	5W	Slight	Severe	Moderate	Moderate	Pin oak	90	72	White ash, eastern white pine, red maple, green ash.
						Swamp white oak	---	---	
						Red maple	71	44	
						White ash	71	77	
						Eastern cottonwood	98	---	
						Green ash	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
PlA, PlB, PlC--- Plainfield	4S	Slight	Slight	Moderate	Slight	Black oak----------- White oak----------- Black cherry-------- Scarlet oak--------- Northern red oak----	70 55 --- 68 ---	52 38 --- 50 ---	Red pine, eastern white pine, jack pine.
RlA, RlB2, RlC2- Riddles	5A	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------ Northern red oak----	90 98 76 90	72 104 70 72	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
Se-------------- Sebewa	5W	Slight	Severe	Severe	Severe	Pin oak------------- White ash----------- White oak----------- Red maple----------- American basswood---	88 75 72 --- ---	70 78 54 --- ---	Eastern white pine, white ash, green ash.
Wa-------------- Wallkill	3W	Slight	Severe	Severe	Severe		---	---	
Wh-------------- Washtenaw	5W	Slight	Severe	Severe	Moderate	Pin oak------------- Northern red oak---- Sweetgum------------ Red maple----------- Silver maple-------- White ash----------- American basswood--- White oak-----------	86 75 90 70 --- --- --- ---	68 57 106 43 --- --- --- ---	Eastern white pine, black spruce, red maple, white ash, white spruce.
WkB, WkC2------- Wawasee	5A	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------ Sugar maple--------- White ash-----------	90 98 72 --- ---	72 104 61 --- ---	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
WkD------------- Wawasee	5R	Moderate	Moderate	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------ Sugar maple--------- White ash-----------	90 98 72 --- ---	72 104 61 --- ---	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ad: Adrian	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Black willow, golden willow.	Imperial Carolina poplar.
Ah: Algansee	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Bb: Barry	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, blue spruce, white fir, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
BlA: Blount	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
Br: Brady	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
BsA: Branch	Manyflower cotoneaster.	Green ash, nannyberry viburnum, silky dogwood, lilac, common ninebark.	White spruce	Eastern white pine, red pine, Norway spruce, red maple.	Imperial Carolina poplar.
BtA: Brems	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Austrian pine, jack pine, red pine.	Eastern white pine	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
ChB: Chelsea	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Austrian pine, jack pine, red pine.	Eastern white pine	---
Co: Cohoctah	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
CrA: Crosier	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, blue spruce, northern white-cedar, Washington hawthorn, white fir.	Norway spruce	Eastern white pine, pin oak.
Ed: Edwards	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Gf, Gh: Gilford	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, northern white-cedar, Washington hawthorn, blue spruce, white fir, Austrian pine.	Eastern white pine	Pin oak.
Hh*: Histosols.					
Aquolls.					
Hk: Homer	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Hm: Houghton	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Ho. Houghton					
KoA*, KoB*, KoC*: Kosciusko	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Amur honeysuckle, Tatarian honeysuckle, Washington hawthorn.	Eastern white pine, red pine, Austrian pine, jack pine.	---	---
Ormas	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle.	Red pine, Austrian pine, jack pine.	Eastern white pine	---
MaA Markton	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
MeA, MeB, MeC Metea	---	Washington hawthorn, Amur honeysuckle, Amur privet, Tatarian honeysuckle, American cranberrybush.	Austrian pine, eastern redcedar, northern white-cedar, osageorange.	Red pine, eastern white pine, Norway spruce.	---
MrB2, MsC3 Morley	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
Mu Morocco	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Mx----------------- Muskego	Common ninebark, whitebelle honeysuckle.	Amur privet, nannyberry viburnum, silky dogwood, Tatarian honeysuckle, Amur honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Ne----------------- Newton	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
OmA, OmB---------- Ormas	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle.	Red pine, Austrian pine, jack pine.	Eastern white pine	---
Pe----------------- Pewamo	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Pk*. Pits					
PlA, PlB, PlC----- Plainfield	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Red pine, Austrian pine, jack pine.	Eastern white pine	---
RlA, RlB2, RlC2--- Riddles	---	Amur privet, Amur honeysuckle, American cranberrybush, Washington hawthorn, Tatarian honeysuckle.	Eastern redcedar, Austrian pine, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Se---------------- Sebewa	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Wa---------------- Wallkill	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Wh---------------- Washtenaw	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
WkB, WkC2, WkD---- Wawasee	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ad------------------- Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Ah------------------- Algansee	Severe: flooding, wetness.	Moderate: wetness, flooding.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
Bb------------------- Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
BlA------------------ Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Br------------------- Brady	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
BsA------------------ Branch	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Moderate: droughty.
BtA------------------ Brems	Moderate: wetness.	Moderate: wetness.	Moderate: small stones.	Slight----------	Moderate: droughty.
ChB------------------ Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
Co------------------- Cohoctah	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
CrA------------------ Crosier	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Ed------------------- Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Gf, Gh--------------- Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Hh*: Histosols.					
Aquolls.					
Hk------------------- Homer	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Hm, Ho--------------- Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
KoA*: Kosciusko------------	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: droughty.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
KoA*:					
Ormas	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
KoB*:					
Kosciusko	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Ormas	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
KoC*:					
Kosciusko	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Ormas	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
MaA Markton	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
MeA Metea	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
MeB Metea	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
MeC Metea	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
MrB2 Morley	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
MsC3 Morley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Mu Morocco	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.
Mx Muskego	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Ne Newton	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
OmA Ormas	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
OmB Ormas	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Pe: Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Pk*. Pits					
PlA, PlB: Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
PlC: Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
RlA: Riddles	Slight	Slight	Moderate: small stones.	Slight	Slight.
RlB2: Riddles	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
RlC2: Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Se: Sebewa	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Wa: Wallkill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, erodes easily.	Severe: ponding.
Wh: Washtenaw	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
WkB: Wawasee	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
WkC2: Wawasee	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
WkD: Wawasee	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Ad----------------- Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ah----------------- Algansee	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Bb----------------- Barry	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.
BlA---------------- Blount	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Br----------------- Brady	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BsA---------------- Branch	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
BtA---------------- Brems	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Poor.
ChB---------------- Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
Co----------------- Cohoctah	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
CrA---------------- Crosier	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ed----------------- Edwards	Very poor.	Poor	Poor	Fair	Poor	Good	Good	Poor	Fair	Good.
Gf, Gh------------- Gilford	Fair	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
Hh*: Histosols.										
Aquolls.										
Hk----------------- Homer	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Hm, Ho------------- Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
KoA*, KoB*: Kosciusko----------	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Ormas--------------	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
KoC*:										
Kosciusko	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Ormas	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MaA Markton	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
MeA, MeB Metea	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
MeC Metea	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MrB2 Morley	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
MsC3 Morley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Mu Morocco	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Fair	Fair	Poor.
Mx Muskego	Good	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ne Newton	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
OmA, OmB Ormas	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Pe Pewamo	Good	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
Pk*. Pits										
PlA, PlB Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
PlC Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
RlA, RlB2 Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RlC2 Riddles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Se Sebewa	Good	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
Wa Wallkill	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wh Washtenaw	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
WkB Wawasee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WkC2 Wawasee	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WkD Wawasee	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ad----------------- Adrian	Severe: ponding, cutbanks cave, excess humus.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
Ah----------------- Algansee	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Moderate: flooding, wetness.
Bb----------------- Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
BlA---------------- Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Br----------------- Brady	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
BsA---------------- Branch	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: droughty.
BtA---------------- Brems	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.
ChB---------------- Chelsea	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty.
Co----------------- Cohoctah	Severe: wetness, cutbanks cave.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action, wetness.	Severe: wetness.
CrA---------------- Crosier	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
Ed----------------- Edwards	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.
Gf, Gh------------- Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Hh*: Histosols.						
Aquolls.						

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Hk---------------- Homer	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Hm, Ho------------ Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
KoA*:						
Kosciusko---------	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.	Moderate: droughty.
Ormas-------------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
KoB*:						
Kosciusko---------	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action.	Moderate: droughty.
Ormas-------------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
KoC*:						
Kosciusko---------	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: droughty, slope.
Ormas-------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
MaA--------------- Markton	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
MeA--------------- Metea	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
MeB--------------- Metea	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
MeC--------------- Metea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
MrB2-------------- Morley	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
MsC3-------------- Morley	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Mu---------------- Morocco	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Mx----------------- Muskego	Severe: excess humus, ponding.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Ne----------------- Newton	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
OmA---------------- Ormas	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
OmB---------------- Ormas	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
Pe----------------- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Pk*. Pits						
PlA---------------- Plainfield	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
PlB---------------- Plainfield	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Severe: droughty.
PlC---------------- Plainfield	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
RlA---------------- Riddles	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
RlB2--------------- Riddles	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.	Slight.
RlC2--------------- Riddles	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
Se----------------- Sebewa	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.
Wa----------------- Wallkill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Wh----------------- Washtenaw	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
WkB---------------- Wawasee	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
WkC2: Wawasee	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
WkD: Wawasee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ad------------------ Adrian	Severe: ponding, poor filter.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, too sandy, seepage.
Ah------------------ Algansee	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Bb------------------ Barry	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
BlA----------------- Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Br------------------ Brady	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
BsA----------------- Branch	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: thin layer.
BtA----------------- Brems	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
ChB----------------- Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Co------------------ Cohoctah	Severe: wetness, flooding.	Severe: flooding, seepage, wetness.	Severe: seepage, flooding, wetness.	Severe: seepage, flooding, wetness.	Poor: wetness.
CrA----------------- Crosier	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ed------------------ Edwards	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Gf------------------ Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Gh------------------ Gilford	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Hh*:					
Histosols.					
Aquolls.					
Hk Homer	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
Hm, Ho Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
KoA*, KoB*:					
Kosciusko	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Ormas	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
KoC*:					
Kosciusko	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Ormas	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
MaA Markton	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
MeA, MeB Metea	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MeC Metea	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MrB2 Morley	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
MsC3 Morley	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, wetness.
Mu Morocco	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Mx: Muskego	Severe: ponding, subsides.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: hard to pack, ponding.
Ne: Newton	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: too sandy, seepage, ponding.
OmA, OmB: Ormas	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Pe: Pewamo	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
Pk*. Pits					
PlA, PlB: Plainfield	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
PlC: Plainfield	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
RlA: Riddles	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
RlB2: Riddles	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
RlC2: Riddles	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
Se: Sebewa	Severe: poor filter, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: small stones, seepage, too sandy.
Wa: Wallkill	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
Wh: Washtenaw	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
WkB: Wawasee	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
WkC2: Wawasee	Moderate: slope, percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
WkD: Wawasee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ad: Adrian	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness, excess humus.
Ah: Algansee	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
Bb: Barry	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
BlA: Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Br: Brady	Fair: wetness.	Probable	Probable	Poor: small stones.
BsA: Branch	Fair: wetness.	Probable	Probable	Fair: too sandy, small stones, area reclaim.
BtA: Brems	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
ChB: Chelsea	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Co: Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
CrA: Crosier	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ed: Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
Gf: Gilford	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Gh: Gilford	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Hh*:				
Histosols.				
Aquolls.				
Hk: Homer	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Hm, Ho: Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
KoA*, KoB*:				
Kosciusko	Good	Probable	Probable	Poor: small stones, area reclaim.
Ormas	Good	Probable	Probable	Fair: too sandy, small stones.
KoC*:				
Kosciusko	Good	Probable	Probable	Poor: small stones, area reclaim.
Ormas	Good	Probable	Probable	Fair: too sandy, small stones, slope.
MaA: Markton	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
MeA, MeB, MeC: Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
MrB2, MsC3: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Mu: Morocco	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
Mx: Muskego	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
Ne: Newton	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
OmA, OmB: Ormas	Good	Probable	Probable	Fair: too sandy, small stones.
Pe: Pewamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Pk*. Pits				
PlA, PlB, PlC: Plainfield	Good	Probable	Improbable: too sandy.	Poor: too sandy.
RlA, RlB2: Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
RlC2: Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Se: Sebewa	Poor: wetness.	Probable	Probable	Poor: wetness, small stones, area reclaim.
Wa: Wallkill	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wh: Washtenaw	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
WkB: Wawasee	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
WkC2: Wawasee	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
WkD: Wawasee	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ad----------------- Adrian	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, frost action, subsides.	Ponding, soil blowing.	Ponding, soil blowing, too sandy.	Wetness.
Ah----------------- Algansee	Severe: seepage.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, soil blowing.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Bb----------------- Barry	Severe: seepage.	Moderate: slow refill.	Ponding, frost action.	Ponding---------	Ponding---------	Wetness.
BlA---------------- Blount	Slight----------	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
Br----------------- Brady	Severe: seepage.	Severe: cutbanks cave.	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
BsA---------------- Branch	Severe: seepage.	Severe: cutbanks cave.	Favorable------	Wetness, droughty, fast intake.	Wetness, soil blowing.	Droughty.
BtA---------------- Brems	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
ChB---------------- Chelsea	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Co----------------- Cohoctah	Severe: seepage.	Severe: cutbanks cave.	Flooding, frost action.	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
CrA---------------- Crosier	Slight----------	Severe: slow refill.	Frost action---	Wetness---------	Wetness---------	Wetness.
Ed----------------- Edwards	Severe: seepage.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
Gf----------------- Gilford	Severe: seepage.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
Gh----------------- Gilford	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Ponding, soil blowing, rooting depth.	Ponding, soil blowing.	Wetness, rooting depth.
Hh*: Histosols.						
Aquolls.						
Hk----------------- Homer	Severe: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, soil blowing.	Erodes easily, wetness.	Wetness, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Hm, Ho Houghton	Severe: seepage.	Severe: slow refill.	Frost action, subsides, ponding.	Soil blowing, ponding.	Ponding, soil blowing.	Wetness.
KoA*:						
Kosciusko	Severe: seepage.	Severe: no water.	Deep to water	Droughty, soil blowing.	Too sandy	Droughty.
Ormas	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Soil blowing	Droughty.
KoB*:						
Kosciusko	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy	Droughty.
Ormas	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing	Droughty.
KoC*:						
Kosciusko	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy.	Slope, droughty.
Ormas	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, soil blowing.	Slope, droughty.
MaA Markton	Severe: seepage.	Severe: cutbanks cave.	Frost action	Wetness, droughty, fast intake.	Wetness, soil blowing.	Wetness, droughty.
MeA Metea	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty, rooting depth.
MeB Metea	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty, rooting depth.
MeC Metea	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
MrB2 Morley	Moderate: slope.	Severe: no water.	Deep to water	Percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
MsC3 Morley	Severe: slope.	Severe: no water.	Deep to water	Percs slowly, slope.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Mu Morocco	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Droughty, fast intake, wetness.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Mx Muskego	Severe: seepage.	Severe: slow refill.	Ponding, percs slowly.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ne: Newton	Severe: seepage.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Droughty, ponding.	Ponding, too sandy, soil blowing.	Wetness, droughty.
OmA: Ormas	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Soil blowing	Droughty.
OmB: Ormas	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing	Droughty.
Pe: Pewamo	Slight	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
Pk*. Pits						
PlA, PlB: Plainfield	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
PlC: Plainfield	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Droughty, slope.
RlA: Riddles	Moderate: seepage.	Severe: no water.	Deep to water	Soil blowing	Soil blowing	Favorable.
RlB2: Riddles	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing	Favorable.
RlC2: Riddles	Severe: slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
Se: Sebewa	Severe: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave, ponding.	Soil blowing, ponding.	Too sandy, soil blowing, ponding.	Wetness.
Wa: Wallkill	Severe: seepage.	Moderate: slow refill.	Ponding, frost action.	Ponding, erodes easily.	Erodes easily, ponding.	Wetness, erodes easily.
Wh: Washtenaw	Moderate: seepage.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
WkB: Wawasee	Moderate: seepage, slope.	Severe: no water.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
WkC2, WkD: Wawasee	Severe: slope.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, soil blowing.	Slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ad---------------- Adrian	0-27	Sapric material	PT	A-8	---	---	---	---	---	---	---
	27-60	Sand, loamy sand, fine sand.	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	NP
Ah---------------- Algansee	0-5	Loamy sand-------	SM	A-2-4	0	100	100	50-75	15-30	---	NP
	5-60	Stratified sand to loam.	SM, SP-SM	A-3, A-2-4	0	100	100	50-70	5-15	---	NP
Bb---------------- Barry	0-13	Loam-------------	ML, CL, CL-ML	A-4	0-3	90-100	80-100	80-100	55-90	20-30	NP-8
	13-41	Loam, sandy clay loam, fine sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-3	90-100	80-100	80-90	45-75	18-28	4-14
	41-60	Sandy loam, fine sandy loam, loam.	SM, SM-SC	A-2, A-4	0-3	90-100	80-100	35-70	30-40	<20	NP-5
BlA--------------- Blount	0-8	Loam-------------	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	8-28	Silty clay loam, clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	80-90	75-85	35-60	15-35
	28-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	90-100	90-100	80-100	70-90	30-45	10-25
Br---------------- Brady	0-8	Sandy loam-------	SM, SM-SC	A-2, A-4	0-5	95-100	75-100	60-70	25-40	<25	NP-7
	8-29	Sandy loam, sandy clay loam, gravelly sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	65-95	60-80	25-45	15-35	NP-16
	29-45	Loamy sand, sandy loam, coarse sandy loam.	SM	A-2	0-5	95-100	75-95	55-70	15-35	---	NP
	45-60	Sand, coarse sand, gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-5	40-75	35-70	20-55	0-10	---	NP
BsA--------------- Branch	0-22	Loamy sand-------	SM	A-2-4	0	95-100	95-100	50-75	15-30	---	NP
	22-45	Gravelly fine sandy loam, sandy clay loam, gravelly loamy sand.	SM, SC, SM-SC	A-2-4, A-4, A-6, A-2-6	0	95-100	60-95	60-85	25-45	<30	NP-15
	45-60	Gravelly sand, very gravelly loamy coarse sand.	SP, SP-SM, GP, GP-GM	A-3, A-1-b, A-2-4	0-5	50-80	40-80	30-55	3-12	---	NP
BtA--------------- Brems	0-12	Loamy sand-------	SM, SP-SM	A-2-4	0	100	85-100	50-85	10-30	---	NP
	12-67	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
	67-80	Sand, fine sand, loamy sand.	SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-10	---	NP
ChB--------------- Chelsea	0-10	Fine sand--------	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	10-80	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Co-------------- Cohoctah	0-21	Fine sandy loam	ML, SM	A-4, A-2	0	100	100	65-95	30-75	<30	NP-6
	21-56	Loam, silt loam, sandy loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	70-90	30-70	<30	NP-10
	56-60	Loam, loamy sand, sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	65-90	20-70	<30	NP-10
CrA------------- Crosier	0-12	Loam-------------	CL	A-4, A-6	0	100	95-100	85-95	60-80	22-33	8-15
	12-36	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	90-95	85-95	75-90	60-70	33-47	15-26
	36-60	Loam, sandy loam, fine sandy loam.	CL, ML	A-4, A-6	0-3	85-90	80-90	70-85	50-60	25-35	2-12
Ed-------------- Edwards	0-33	Sapric material	PT	A-8	0	---	---	---	---	---	---
	33-60	Marl-------------	---	---	0	100	95-100	80-90	60-80	---	---
Gf-------------- Gilford	0-10	Fine sandy loam	SM, SC, SM-SC	A-4	0	95-100	90-100	65-80	35-45	<25	2-10
	10-24	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	20-35	15-30	NP-8
	24-60	Loamy sand, sand, coarse sand.	SM, SP, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	18-60	3-20	---	NP
Gh-------------- Gilford	0-13	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	95-100	95-100	65-85	35-55	16-21	3-6
	13-22	Loamy sand, sand	SP-SM, SM	A-1, A-3, A-2-4	0	85-100	80-100	40-75	5-25	---	NP
	22-51	Fine sandy loam, sandy loam.	SM, SM-SC, ML, CL-ML	A-2-4, A-4	0	85-100	80-100	50-80	25-55	16-23	3-7
	51-60	Gravelly coarse sandy loam, silt loam, loam.	SM, SM-SC, ML, CL-ML	A-2-4, A-4, A-1-b	0	85-100	70-100	45-95	20-90	16-25	3-8
Hh*: Histosols.											
Aquolls.											
Hk-------------- Homer	0-16	Sandy loam, fine sandy loam.	SM-SC, SM	A-2-4, A-4	0	95-100	85-100	60-70	30-40	20-30	5-10
	16-22	Sandy clay loam, gravelly loam, gravelly sandy loam.	SC	A-2-6, A-6, A-4, A-2-4	0-3	90-100	60-85	45-60	30-50	25-30	8-11
	22-35	Stratified gravelly loamy sand to sandy clay loam.	SM, SM-SC, SP-SM, SC	A-2, A-4, A-1-b, A-3	0-5	90-95	60-75	40-60	5-45	<30	NP-10
	35-60	Stratified sand to gravelly loamy coarse sand.	SP, GP, SP-SM, GP-GM	A-1	1-5	30-70	25-70	7-20	2-10	<20	NP-3
Hm, Ho---------- Houghton	0-80	Sapric material	PT	A-8	0	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
KoA*, KoB*, KoC*:											
Kosciusko-------	0-14	Fine sandy loam, loamy sand.	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	85-100	80-100	50-90	30-70	<30	NP-10
	14-31	Gravelly sandy clay loam, sandy loam, sandy clay loam.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2, A-1	0-3	55-80	55-75	35-65	15-40	20-40	5-20
	31-60	Stratified very gravelly coarse sand to coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-8	30-60	30-55	15-40	2-10	<20	NP
Ormas-----------	0-16	Loamy sand-------	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
	16-29	Sand, fine sand	SW-SM, SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-70	10-20	---	NP
	29-48	Sandy loam, fine sandy loam.	SM-SC, SM	A-2-4, A-4	0	90-100	85-100	50-70	25-40	<15	NP-5
	48-60	Gravelly sand, very gravelly coarse sand, gravelly coarse sand.	SP, SP-SM	A-3, A-1-b, A-2-4	0	60-80	55-80	30-55	3-12	---	NP
MaA-------------- Markton	0-10	Loamy sand-------	SM	A-2-4	0	100	95-100	50-75	15-30	---	NP
	10-32	Sand, loamy sand, fine sand.	SP-SM, SM	A-2-4, A-1-b, A-3	0	100	95-100	45-75	5-30	---	NP
	32-38	Sandy loam, loam, fine sandy loam.	ML, CL-ML, SM, SM-SC	A-4, A-2-4	0-3	95-100	90-100	60-95	30-70	18-25	NP-7
	38-60	Loam-------------	ML, CL-ML	A-4	0-3	95-100	90-100	80-95	55-75	14-21	NP-6
MeA, MeB, MeC---- Metea	0-10	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	NP
	10-25	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4, A-3	0	100	100	50-80	5-35	---	NP
	25-30	Sandy clay loam, fine sandy loam, sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-2-4	0	95-100	95-100	55-90	15-75	<27	4-9
	30-40	Loam, clay loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	10-15
	40-60	Loam-------------	CL, CL-ML	A-4	0-3	85-95	75-95	65-90	50-75	<25	5-10
MrB2------------- Morley	0-9	Loam-------------	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	75-95	25-40	5-15
	9-18	Silty clay, clay loam, clay.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	18-39	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-35
	39-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
MsC3------------- Morley	0-9	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	80-90	30-45	15-25
	9-18	Silty clay, clay loam, clay.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	18-39	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-35
	39-60	Silty clay loam, clay loam, clay.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
Mu--------------- Morocco	0-10	Loamy sand-------	SM, SM-SC	A-2-4	0	100	100	50-85	15-35	<20	NP-5
	10-60	Fine sand, sand	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Mx--------------- Muskego	0-20	Sapric material	PT	A-8	0	---	---	---	---	---	---
	20-60	Coprogenous earth	OL	A-5	0	95-100	95-100	85-100	75-96	40-50	2-8
Ne--------------- Newton	0-18	Fine sandy loam, loamy sand.	SC, SM-SC	A-4, A-6, A-2	0	100	100	60-80	30-50	15-25	5-15
	18-60	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2-4, A-3	0	100	100	50-75	5-25	---	NP
OmA, OmB--------- Ormas	0-10	Loamy sand--------	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
	10-37	Sand, fine sand	SW-SM, SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-70	10-20	---	NP
	37-56	Sandy loam, fine sandy loam, loamy sand.	SM-SC, SM	A-2-4, A-4	0	90-100	85-100	50-70	25-40	<15	NP-5
	56-60	Gravelly sand, very gravelly coarse sand, gravelly coarse sand.	SP, SP-SM	A-3, A-1-b, A-2-4	0	60-80	55-80	30-55	3-12	---	NP
Pe--------------- Pewamo	0-9	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-100	80-100	70-90	35-50	15-25
	9-36	Clay loam, clay, silty clay.	CL, CH	A-7, A-6	0-5	95-100	90-100	90-100	75-95	35-55	15-30
	36-60	Clay loam, silty clay loam, silty clay.	CL	A-7	0-5	95-100	90-100	90-100	70-90	40-50	15-25
Pk*. Pits											
PlA, PlB, PlC---- Plainfield	0-4	Sand-------------	SP-SM, SM, SP	A-3, A-2, A-1	0	75-100	75-100	40-80	3-35	---	NP
	4-25	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-70	1-15	---	NP
	25-60	Sand, fine sand	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-90	1-15	---	NP
RlA, RlB2, RlC2-- Riddles	0-11	Fine sandy loam	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	11-14	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	14-46	Clay loam, sandy clay loam.	CL	A-6, A-7	0	90-100	80-95	75-95	65-75	35-50	15-30
	46-60	Fine sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
Se--------------- Sebewa	0-11	Sandy clay loam	SM, SM-SC, SC	A-2-4, A-4	0	95-100	80-100	55-70	25-40	<30	NP-10
	11-30	Sandy clay loam, loam, clay loam.	SC, CL	A-4, A-6	0	95-100	65-95	55-85	40-75	25-40	8-20
	30-60	Gravelly sand, gravelly coarse sandy loam, gravelly loamy coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0-5	40-75	35-70	20-40	0-10	---	NP
Wa--------------- Wallkill	0-10	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	95-100	90-100	75-100	60-85	16-32	3-12
	10-30	Silt loam, loam	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-100	60-85	20-34	6-13
	30-60	Sapric material, hemic material.	PT, OH	A-8	0	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Wh--------------- Washtenaw	0-10	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	27-36	4-12
	10-50	Silt loam, loam, fine sandy loam.	CL, ML	A-6, A-4	0	100	100	70-100	50-90	27-36	4-12
	50-60	Loam, silt loam	CL	A-4, A-6	0-3	90-100	85-95	80-95	60-80	22-33	8-15
WkB, WkC2, WkD--- Wawasee	0-10	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	90-100	85-95	80-95	30-50	<25	NP-6
	10-39	Loam, sandy clay loam.	CL, SC	A-4, A-6	0	90-100	85-95	80-95	45-70	25-35	7-15
	39-60	Loam, sandy loam, fine sandy loam.	SM-SC, SC, CL-ML, CL	A-4, A-6, A-2	0	90-100	80-95	50-90	25-66	20-30	4-12

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Ad---------------	0-27	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8	-------------	----	2	2	55-75
Adrian	27-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	Low----------	----			
Ah---------------	0-5	0-15	1.35-1.50	6.0-20	0.10-0.12	5.6-7.8	Low----------	0.17	5	2	1-4
Algansee	5-60	0-18	1.40-1.65	6.0-20	0.05-0.07	5.6-7.8	Low----------	0.17			
Bb---------------	0-13	8-18	1.60-1.75	0.6-2.0	0.20-0.22	6.1-7.8	Low----------	0.28	5	5	4-7
Barry	13-41	18-25	1.25-1.85	0.6-2.0	0.14-0.19	6.1-7.8	Low----------	0.28			
	41-60	5-18	1.80-2.00	2.0-6.0	0.10-0.13	7.4-8.4	Low----------	0.28			
BlA--------------	0-8	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.43	3	6	2-3
Blount	8-28	35-50	1.40-1.70	0.06-0.6	0.12-0.19	4.5-7.3	Moderate-----	0.43			
	28-60	27-38	1.60-1.85	0.06-0.6	0.07-0.10	7.4-8.4	Moderate-----	0.43			
Br---------------	0-8	2-15	1.25-1.40	2.0-6.0	0.12-0.15	5.6-7.3	Low----------	0.20	5	3	1-4
Brady	8-29	5-22	1.35-1.45	2.0-6.0	0.12-0.17	5.1-6.5	Low----------	0.20			
	29-45	5-20	1.25-1.50	2.0-6.0	0.08-0.10	5.1-7.3	Low----------	0.20			
	45-60	0-10	1.25-1.50	>20	0.02-0.04	6.6-8.4	Low----------	0.10			
BsA--------------	0-22	5-12	1.40-1.60	6.0-20	0.10-0.12	4.5-7.3	Low----------	0.17	5	2	.5-3
Branch	22-45	10-25	1.25-1.60	2.0-6.0	0.08-0.18	4.5-7.3	Low----------	0.24			
	45-60	1-8	1.50-1.70	>20	0.02-0.05	7.4-8.4	Low----------	0.15			
BtA--------------	0-12	3-7	1.50-1.65	6.0-20	0.10-0.12	5.1-6.5	Low----------	0.17	5	2	.5-1
Brems	12-67	2-6	1.60-1.75	6.0-20	0.05-0.08	4.5-6.0	Low----------	0.17			
	67-80	2-6	1.60-1.75	6.0-20	0.05-0.07	5.1-6.5	Low----------	0.17			
ChB--------------	0-10	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low----------	0.17	5	2	.5-1
Chelsea	10-80	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-7.3	Low----------	0.17			
Co---------------	0-21	5-20	1.20-1.60	2.0-6.0	0.13-0.22	6.1-7.8	Low----------	0.28	5	3	1-4
Cohoctah	21-56	5-27	1.45-1.65	2.0-6.0	0.12-0.20	6.1-8.4	Low----------	0.28			
	56-60	2-25	1.45-1.65	2.0-6.0	0.08-0.20	6.1-8.4	Low----------	0.28			
CrA--------------	0-12	7-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.32	5	5	1-3
Crosier	12-36	20-33	1.40-1.60	0.2-0.6	0.15-0.19	5.1-7.8	Moderate-----	0.32			
	36-60	10-20	1.40-1.60	0.2-0.6	0.10-0.19	6.1-8.4	Low----------	0.32			
Ed---------------	0-33	---	0.30-0.55	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	2	2	55-75
Edwards	33-60	---	---	---	---	7.4-8.4	-------------	----			
Gf---------------	0-10	10-20	1.50-1.70	2.0-6.0	0.16-0.18	5.6-7.3	Low----------	0.20	4	3	2-4
Gilford	10-24	8-24	1.60-1.80	2.0-6.0	0.12-0.14	5.6-7.3	Low----------	0.20			
	24-60	3-12	1.70-1.90	6.0-20	0.05-0.08	6.1-8.4	Low----------	0.15			
Gh---------------	0-13	10-16	1.50-1.70	2.0-6.0	0.16-0.22	5.6-7.3	Low----------	0.20	5	3	2-4
Gilford	13-22	2-9	1.70-1.80	2.0-6.0	0.06-0.11	5.6-7.3	Low----------	0.20			
	22-51	10-18	1.60-1.70	0.2-6.0	0.11-0.16	5.6-7.8	Low----------	0.20			
	51-60	10-20	1.50-1.80	0.2-0.6	0.11-0.22	7.9-8.4	Low----------	0.15			
Hh*:											
Histosols.											
Aquolls.											

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Hk------------- Homer	0-16	6-15	1.40-1.60	0.6-2.0	0.13-0.15	5.1-7.3	Low----------	0.24	4	3	1-3
	16-22	17-27	1.45-1.65	0.6-2.0	0.15-0.17	5.1-7.3	Low----------	0.37			
	22-35	5-25	1.45-1.70	0.6-2.0	0.09-0.15	6.1-7.8	Low----------	0.24			
	35-60	1-10	1.65-1.95	>20	0.01-0.04	7.9-8.4	Low----------	0.10			
Hm, Ho---------- Houghton	0-80	---	0.15-0.45	0.2-6.0	0.35-0.45	5.1-7.8	-------------	----	2	2	>70
KoA*, KoB*, KoC*: Kosciusko-------	0-14	7-25	1.30-1.45	0.6-2.0	0.13-0.20	5.1-6.5	Low----------	0.28	4	3	.5-2
	14-31	18-27	1.40-1.60	0.6-2.0	0.10-0.15	5.1-7.3	Moderate-----	0.28			
	31-60	1-5	1.70-1.90	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
Ormas-----------	0-16	5-12	1.40-1.60	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	1-3
	16-29	3-10	1.45-1.60	6.0-20	0.07-0.09	5.6-6.5	Low----------	0.17			
	29-48	10-20	1.50-1.70	2.0-6.0	0.12-0.14	5.1-6.5	Low----------	0.17			
	48-60	1-8	1.55-1.70	>20	0.03-0.05	7.4-8.4	Low----------	0.15			
MaA------------- Markton	0-10	3-7	1.40-1.55	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	1-3
	10-32	2-8	1.50-1.70	6.0-20	0.06-0.11	5.6-7.3	Low----------	0.17			
	32-38	12-20	1.50-1.70	0.6-2.0	0.12-0.19	6.1-7.8	Low----------	0.28			
	38-60	8-16	1.50-1.70	0.6-2.0	0.17-0.19	7.4-8.4	Low----------	0.28			
MeA, MeB, MeC---- Metea	0-10	3-8	1.55-1.65	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	.5-2
	10-25	2-10	1.65-1.80	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	25-30	12-22	1.45-1.55	0.6-2.0	0.15-0.19	5.6-6.5	Low----------	0.32			
	30-40	27-35	1.45-1.65	0.6-2.0	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	40-60	10-24	1.55-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.32			
MrB2------------ Morley	0-9	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.43	3	6	2-3
	9-18	35-50	1.55-1.70	0.2-0.6	0.11-0.15	5.6-7.8	Moderate-----	0.43			
	18-39	27-50	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
	39-60	27-40	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
MsC3------------ Morley	0-9	27-35	1.40-1.60	0.2-0.6	0.18-0.22	5.1-7.3	Moderate-----	0.43	2	7	2-3
	9-18	35-50	1.55-1.70	0.2-0.6	0.11-0.15	5.6-7.8	Moderate-----	0.43			
	18-39	27-50	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
	39-60	27-40	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
Mu-------------- Morocco	0-10	1-6	1.40-1.60	6.0-20	0.10-0.12	5.1-6.5	Low----------	0.17	5	2	.5-2
	10-60	1-6	1.50-1.70	6.0-20	0.05-0.07	4.5-6.0	Low----------	0.15			
Mx-------------- Muskego	0-20	0	0.10-0.21	0.6-6.0	0.35-0.45	4.5-7.3	-------------	----	2	2	>50
	20-60	18-35	0.30-1.10	0.06-0.2	0.18-0.24	6.6-8.4	Moderate-----	0.28			
Ne-------------- Newton	0-18	4-12	1.40-1.60	6.0-20	0.13-0.18	5.1-6.5	Low----------	0.17	5	3	2-4
	18-60	2-7	1.60-1.75	6.0-20	0.05-0.07	4.5-6.0	Low----------	0.17			
OmA, OmB--------- Ormas	0-10	5-12	1.40-1.60	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	1-3
	10-37	3-10	1.45-1.60	6.0-20	0.07-0.09	5.6-7.3	Low----------	0.17			
	37-56	10-20	1.50-1.70	2.0-6.0	0.12-0.14	5.1-7.3	Low----------	0.17			
	56-60	1-8	1.55-1.70	>20	0.03-0.05	7.4-8.4	Low----------	0.15			
Pe-------------- Pewamo	0-9	27-40	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.3	Moderate-----	0.28	5	6	3-10
	9-36	35-50	1.40-1.70	0.2-0.6	0.12-0.20	5.6-7.8	Moderate-----	0.28			
	36-60	30-45	1.50-1.75	0.2-0.6	0.14-0.18	7.4-8.4	Moderate-----	0.28			
Pk*. Pits											

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
PlA, PlB, PlC----Plainfield	0-4	2-5	1.50-1.65	6.0-20	0.04-0.09	4.5-7.3	Low----------	0.15	5	1	<1
	4-25	0-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.5	Low----------	0.17			
	25-60	0-4	1.50-1.70	6.0-20	0.04-0.07	4.5-6.5	Low----------	0.17			
RlA, RlB2, RlC2--Riddles	0-11	4-14	1.35-1.55	2.0-6.0	0.13-0.15	6.1-7.3	Low----------	0.24	5	3	.5-2
	11-14	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate-----	0.32			
	14-46	20-35	1.40-1.60	0.6-2.0	0.15-0.19	4.5-7.3	Moderate-----	0.32			
	46-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low----------	0.32			
Se---------------Sebewa	0-11	20-25	1.15-1.60	0.6-2.0	0.12-0.20	6.1-7.8	Low----------	0.24	4	3	1-8
	11-30	18-35	1.50-1.80	0.6-2.0	0.15-0.19	6.1-7.8	Low----------	0.24			
	30-60	0-3	1.55-1.75	6.0-20	0.02-0.04	7.4-8.4	Low----------	0.10			
Wa---------------Wallkill	0-10	10-27	1.15-1.40	0.6-2.0	0.16-0.21	5.1-7.8	Low----------	0.37	5	---	3-8
	10-30	15-27	1.15-1.40	0.6-2.0	0.15-0.20	5.1-7.8	Low----------	0.32			
	30-60	---	0.25-0.45	2.0-20	0.35-0.45	4.5-7.8	-------------	----			
Wh---------------Washtenaw	0-10	15-27	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	5	3-7
	10-50	15-27	1.30-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
	50-60	15-25	1.45-1.65	0.06-0.2	0.05-0.19	6.6-8.4	Moderate-----	0.37			
WkB, WkC2, WkD---Wawasee	0-10	10-18	1.20-1.40	0.6-2.0	0.13-0.15	5.6-7.3	Low----------	0.28	5	3	1-3
	10-39	18-27	1.50-1.70	0.6-2.0	0.12-0.18	5.1-7.3	Low----------	0.28			
	39-60	12-18	1.50-1.70	0.6-2.0	0.11-0.18	6.6-8.4	Low----------	0.28			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "frequent," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Ad------ Adrian	A/D	None------	---	---	+1-1.0	Apparent	Nov-May	High-----	High-----	Moderate.
Ah------ Algansee	B	Frequent----	Long------	Nov-May	1.0-2.0	Apparent	Nov-May	Moderate	Low------	Low.
Bb------ Barry	B/D	None------	---	---	+1-1.0	Apparent	Nov-May	High-----	High-----	Low.
BlA------ Blount	C	None------	---	---	1.0-3.0	Perched	Jan-May	High-----	High-----	High.
Br------ Brady	B	None------	---	---	1.0-3.0	Apparent	Nov-May	High-----	Low------	Moderate.
BsA------ Branch	B	None------	---	---	2.0-3.5	Apparent	Nov-Apr	Moderate	Low------	Moderate.
BtA------ Brems	A	None------	---	---	2.0-3.0	Apparent	Jan-Apr	Low------	Low------	High.
ChB------ Chelsea	A	None------	---	---	>6.0	---	---	Low------	Low------	Low.
Co------ Cohoctah	B/D	Occasional	Brief to long.	Nov-Apr	0-1.0	Apparent	Sep-May	High-----	High-----	Low.
CrA------ Crosier	C	None------	---	---	1.0-3.0	Apparent	Jan-Apr	High-----	High-----	Low.
Ed------ Edwards	B/D	None------	---	---	+1-0.5	Apparent	Sep-Jun	High-----	High-----	Low.
Gf, Gh------ Gilford	B/D	None------	---	---	+.5-1.0	Apparent	Dec-May	High-----	High-----	Moderate.
Hh*:										
Histosols.										
Aquolls.										
Hk------ Homer	B	None------	---	---	1.0-3.0	Apparent	Jan-Apr	High-----	High-----	High.
Hm, Ho------ Houghton	A/D	None------	---	---	+1-1.0	Apparent	Sep-Jun	High-----	High-----	Low.
KoA*, KoB*, KoC*:										
Kosciusko------	B	None------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
Ormas------	B	None------	---	---	>6.0	---	---	Moderate	Low------	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
MaA: Markton	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	High	Moderate	Low.
MeA, MeB, MeC: Metea	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
MrB2, MsC3: Morley	C	None	---	---	3.0-6.0	Perched	Mar-May	Moderate	High	Moderate.
Mu: Morocco	B	None	---	---	1.0-2.0	Apparent	Jan-Apr	Moderate	Low	High.
Mx: Muskego	A/D	None	---	---	+1-1.0	Apparent	Nov-Aug	High	Moderate	Moderate.
Ne: Newton	A/D	None	---	---	+.5-1.0	Apparent	Dec-May	Moderate	High	High.
OmA, OmB: Ormas	B	None	---	---	>6.0	---	---	Moderate	Low	Moderate.
Pe: Pewamo	C/D	None	---	---	+1-1.0	Apparent	Dec-May	High	High	Low.
Pk*. Pits										
PlA, PlB, PlC: Plainfield	A	None	---	---	>6.0	---	---	Low	Low	High.
RlA, RlB2, RlC2: Riddles	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Se: Sebewa	B/D	None	---	---	+1-1.0	Apparent	Sep-May	High	High	Low.
Wa: Wallkill	B/D	None	---	---	+.5-1.0	Apparent	Sep-Jun	High	Moderate	Moderate.
Wh: Washtenaw	C/D	None	---	---	+.5-1.0	Apparent	Dec-May	High	High	Low.
WkB, WkC2, WkD: Wawasee	B	None	---	---	>6.0	---	---	Moderate	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Algansee	Mixed, mesic Aquic Udipsamments
Aquolls	Loamy, mixed, mesic Typic Haplaquolls
Barry	Fine-loamy, mixed, mesic Typic Argiaquolls
Blount	Fine, illitic, mesic Aeric Ochraqualfs
Brady	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Branch	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Brems	Mixed, mesic Aquic Udipsamments
Chelsea	Mixed, mesic Alfic Udipsamments
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Crosier	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Edwards	Marly, euic, mesic Limnic Medisaprists
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Histosols	Euic, mesic Medisaprists
Homer	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aeric Ochraqualfs
Houghton	Euic, mesic Typic Medisaprists
Kosciusko	Fine-loamy, mixed, mesic Typic Hapludalfs
Markton	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Metea	Loamy, mixed, mesic Arenic Hapludalfs
Morley	Fine, illitic, mesic Typic Hapludalfs
Morocco	Mixed, mesic Aquic Udipsamments
Muskego	Coprogenous, euic, mesic Limnic Medisaprists
Newton	Sandy, mixed, mesic Typic Humaquepts
Ormas	Loamy, mixed, mesic Arenic Hapludalfs
Pewamo	Fine, mixed, mesic Typic Argiaquolls
Plainfield	Mixed, mesic Typic Udipsamments
Riddles	Fine-loamy, mixed, mesic Typic Hapludalfs
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
*Wallkill	Fine-loamy, mixed, nonacid, mesic Thapto-Histic Fluvaquents
*Washtenaw	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Wawasee	Fine-loamy, mixed, mesic Typic Hapludalfs

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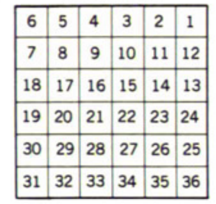

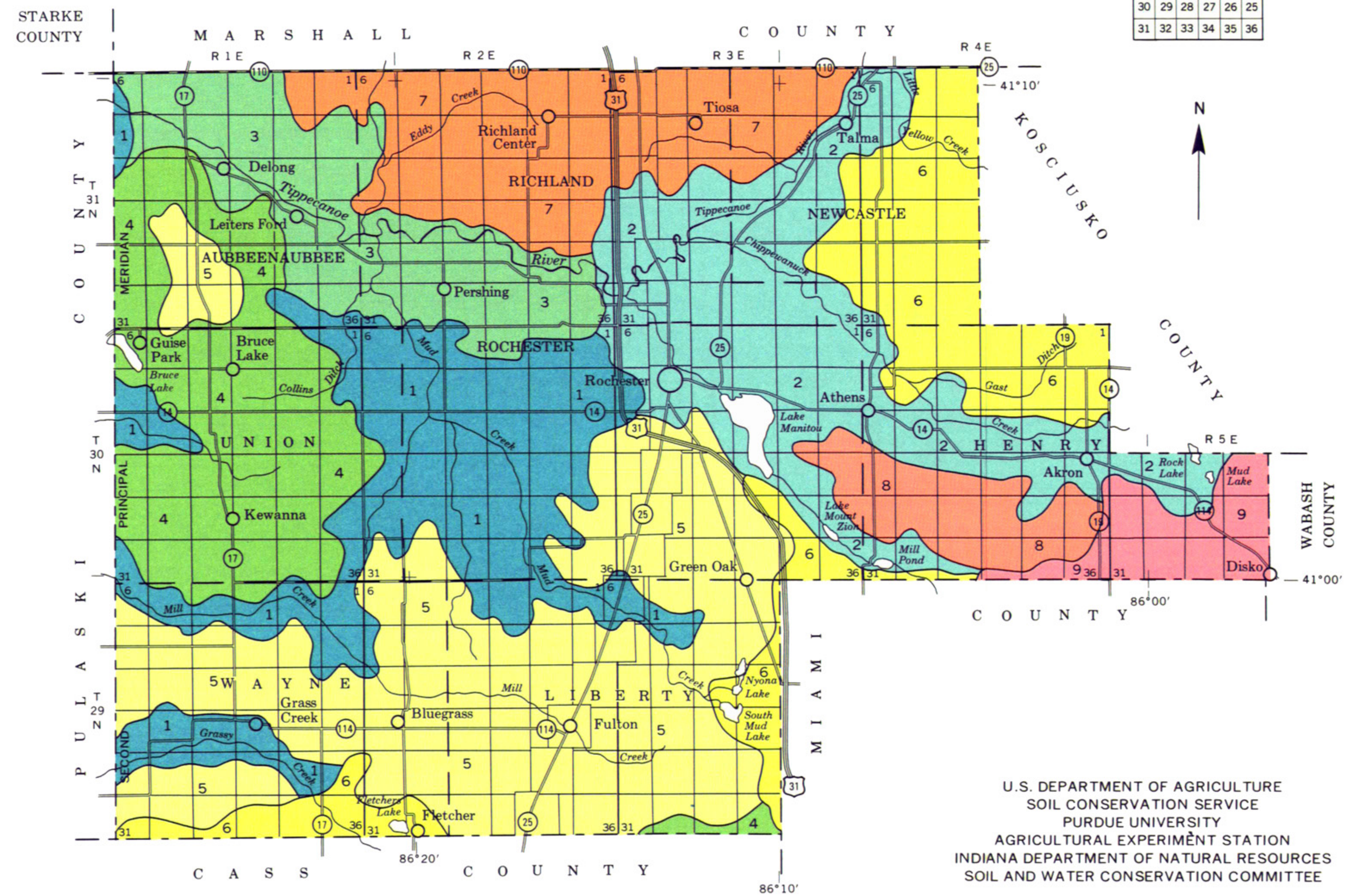

LEGEND

AREAS DOMINATED BY NEARLY LEVEL, VERY POORLY DRAINED AND POORLY DRAINED SOILS ON OUTWASH PLAINS, TILL PLAINS, AND LAKE PLAINS

1 — Gilford-Barry association: Nearly level, very poorly drained and poorly draind soils formed in loamy and sandy sediments and glacial till; on uplands

AREAS DOMINATED BY NEARLY LEVEL TO MODERATELY SLOPING, WELL DRAINED SOILS ON OUTWASH PLAINS AND TERRACES

2 — Kosciusko-Ormas association: Nearly level to moderately sloping, well drained soils formed in loamy and sandy outwash and eolian material; on uplands

AREAS DOMINATED BY NEARLY LEVEL TO MODERATELY SLOPING, EXCESSIVELY DRAINED, WELL DRAINED, AND VERY POORLY DRAINED SOILS ON OUTWASH PLAINS, TERRACES, AND LAKE PLAINS

3 — Plainfield-Ormas-Newton association: Nearly level to moderately sloping, excessively drained, well drained, and very poorly drained soils formed in loamy and sandy outwash and eolian material; on uplands

AREAS DOMINATED BY NEARLY LEVEL TO MODERATELY SLOPING, SOMEWHAT POORLY DRAINED AND WELL DRAINED SOILS ON LAKE PLAINS, TILL PLAINS, AND MORAINES

4 — Markton-Metea association: Nearly level to moderately sloping, somewhat poorly drained and well drained soils formed in sandy material overlying loamy glacial till; on uplands

AREAS DOMINATED BY NEARLY LEVEL TO STRONGLY SLOPING, SOMEWHAT POORLY DRAINED, POORLY DRAINED, AND WELL DRAINED SOILS ON TILL PLAINS AND MORAINES

5 — Crosier-Barry association: Nearly level, somewhat poorly drained and poorly drained soils formed in loamy glacial till; on uplands

6 — Wawasee-Crosier-Barry association: Nearly level to strongly sloping, well drained, somewhat poorly drained, and poorly drained soils formed in loamy glacial till; on uplands

7 — Riddles-Crosier association: Nearly level to moderately sloping, well drained and somewhat poorly drained soils formed in glacial till; on uplands

8 — Crosier-Wawasee-Metea association: Nearly level to strongly sloping, well drained and somewhat poorly drained soils formed in loamy glacial till and eolian material; on uplands

AREAS DOMINATED BY NEARLY LEVEL TO MODERATELY SLOPING, WELL DRAINED TO VERY POORLY DRAINED SOILS ON TILL PLAINS AND MORAINES

9 — Morley-Blount-Pewamo association: Nearly level to moderately sloping, well drained to very poorly drained soils formed in glacial till; on uplands

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SOIL CONSERVATION SERVICE
PURDUE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
INDIANA DEPARTMENT OF NATURAL RESOURCES
SOIL AND WATER CONSERVATION COMMITTEE

GENERAL SOIL MAP

FULTON COUNTY, INDIANA

Scale 1:190,080

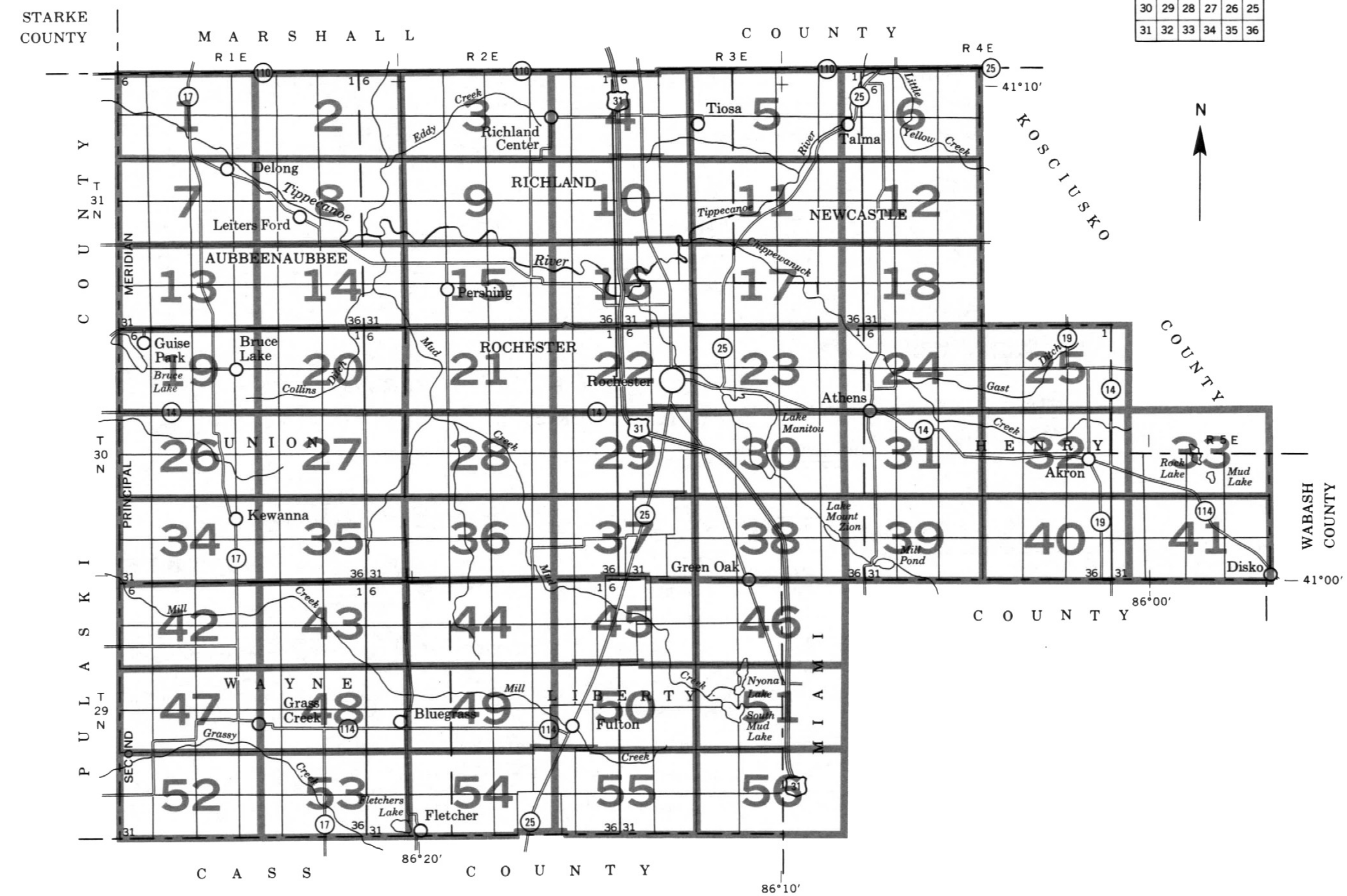
1 0 1 2 3 Miles

1 0 3 6 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



Original text from each individual map sheet read:
This map is compiled on 1978 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS

FULTON COUNTY, INDIANA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is eroded and 3 that it is severely eroded.

SYMBOL	NAME
Ad	Adrian muck, drained
Ah	Algansee loamy sand, frequently flooded
Bb	Barry loam
BlA	Blount loam, 0 to 2 percent slopes
Br	Brady sandy loam
BsA	Branch loamy sand, 0 to 2 percent slopes
BtA	Brems loamy sand, 0 to 3 percent slopes
ChB	Chelsea fine sand, 2 to 6 percent slopes
Co	Cohoctah fine sandy loam, occasionally flooded
CrA	Crosier loam, 0 to 2 percent slopes
Ed	Edwards muck, drained
Gf	Gilford fine sandy loam
Gh	Gilford fine sandy loam, loamy substratum
Hh	Histosols-Aquolls complex, ponded
Hk	Homer fine sandy loam, 0 to 2 percent slopes
Hm	Houghton muck, drained
Ho	Houghton muck, undrained
KoA	Kosciusko-Ormas complex, 0 to 2 percent slopes
KoB	Kosciusko-Ormas complex, 2 to 6 percent slopes
KoC	Kosciusko-Ormas complex, 6 to 12 percent slopes
MaA	Markton loamy sand, 0 to 2 percent slopes
MeA	Metea loamy sand, 0 to 2 percent slopes
MeB	Metea loamy sand, 2 to 6 percent slopes
MeC	Metea loamy sand, 6 to 12 percent slopes
MrB2	Morley loam, 2 to 6 percent slopes, eroded
MsC3	Morley clay loam, 6 to 12 percent slopes, severely eroded
Mu	Morocco loamy sand
Mx	Muskego muck, drained
Ne	Newton fine sandy loam
OmA	Ormas loamy sand, 0 to 2 percent slopes
OmB	Ormas loamy sand, 2 to 6 percent slopes
Pe	Pewamo clay loam
Pk	Pits, gravel
PlA	Plainfield sand, 0 to 2 percent slopes
PlB	Plainfield sand, 2 to 6 percent slopes
PlC	Plainfield sand, 6 to 12 percent slopes
RlA	Riddles fine sandy loam, 0 to 2 percent slopes
RlB2	Riddles fine sandy loam, 2 to 6 percent slopes, eroded
RlC2	Riddles fine sandy loam, 6 to 12 percent slopes, eroded
Se	Sebewa sandy clay loam
Wa	Wallkill silt loam
Wh	Washtenaw silt loam
WkB	Wawasee fine sandy loam, 2 to 6 percent slopes
WkC2	Wawasee fine sandy loam, 6 to 12 percent slopes, eroded
WkD	Wawasee fine sandy loam, 12 to 18 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedley Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — Br, OmB

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

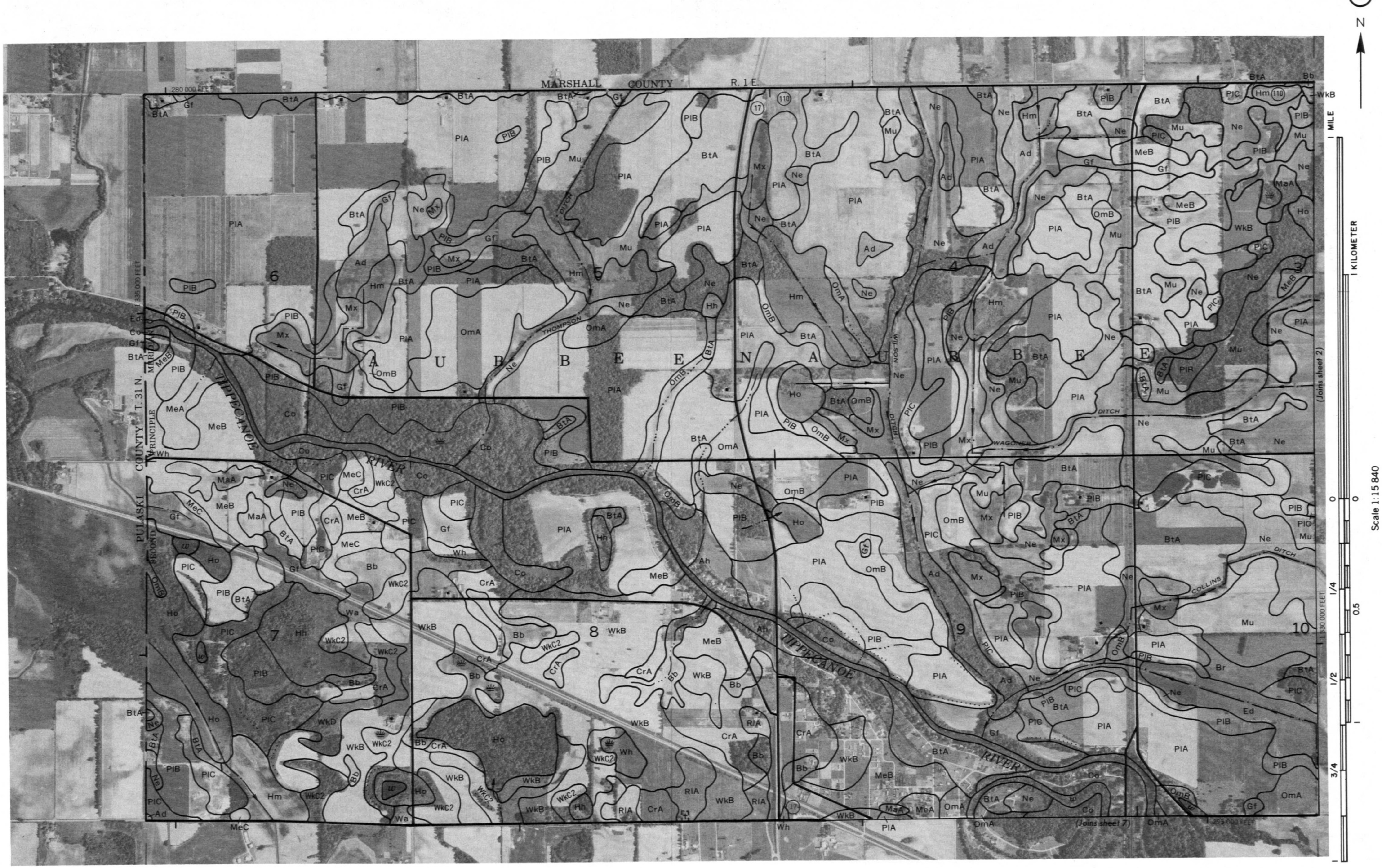
GULLY

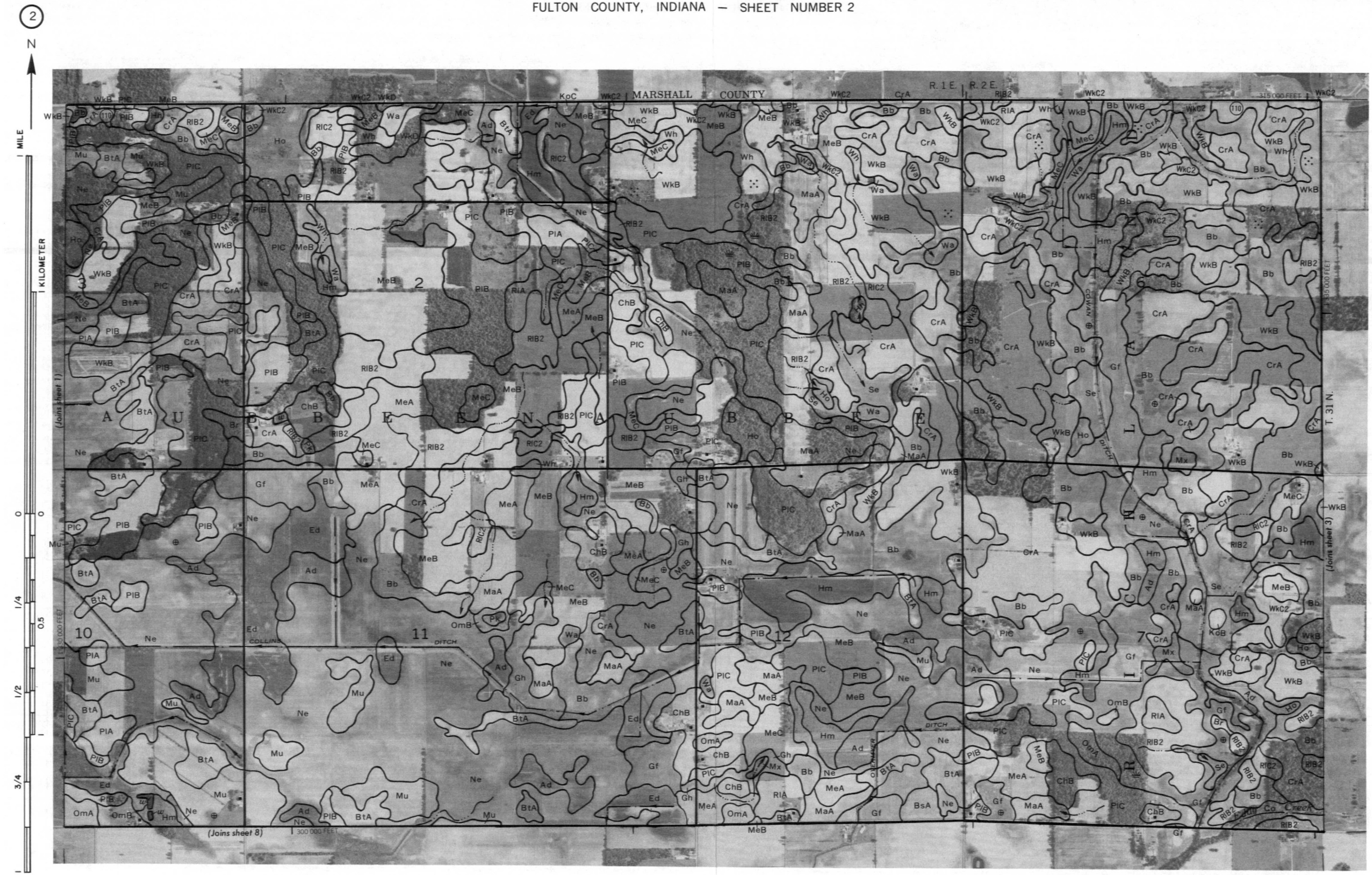
DEPRESSION OR SINK

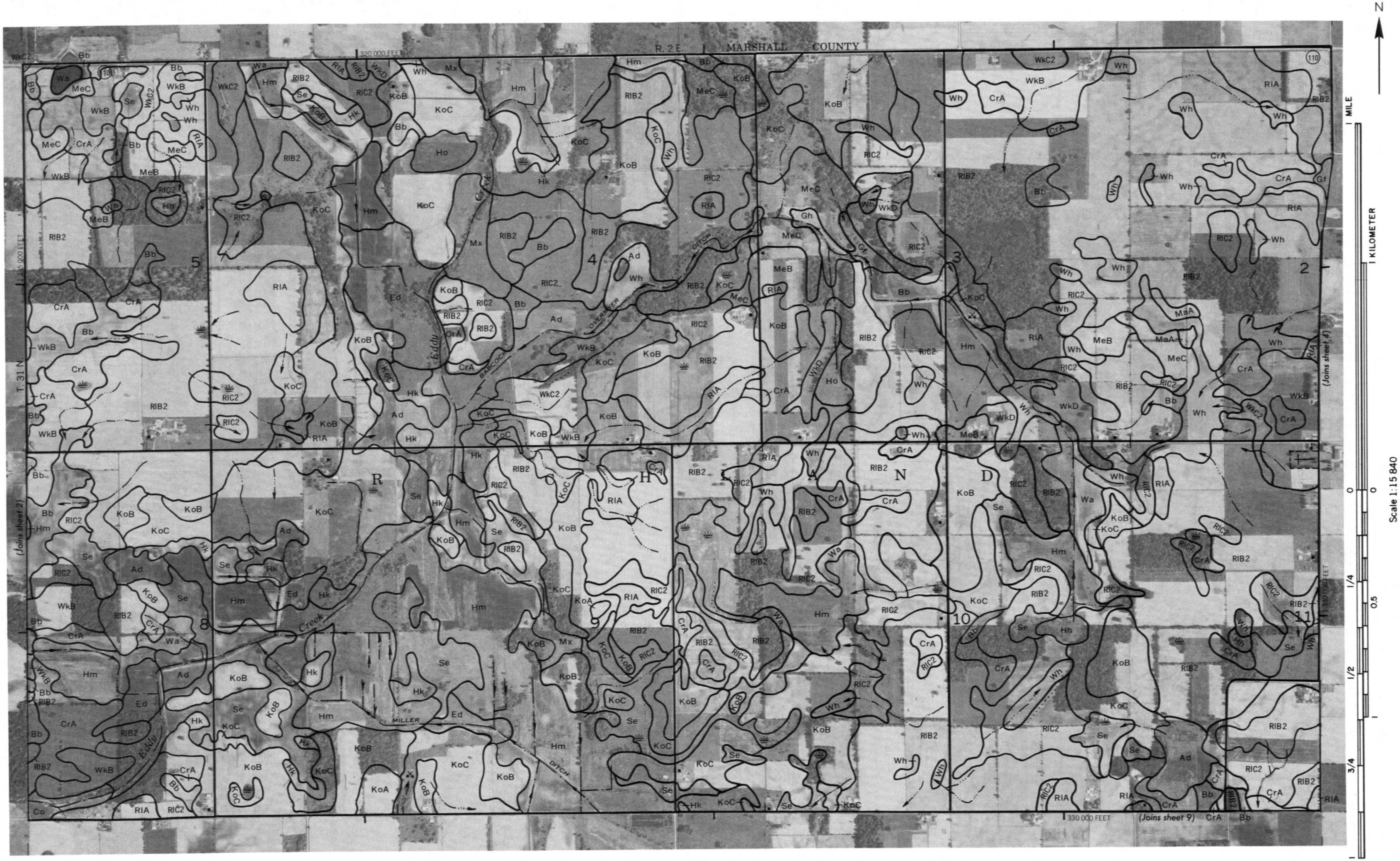
SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

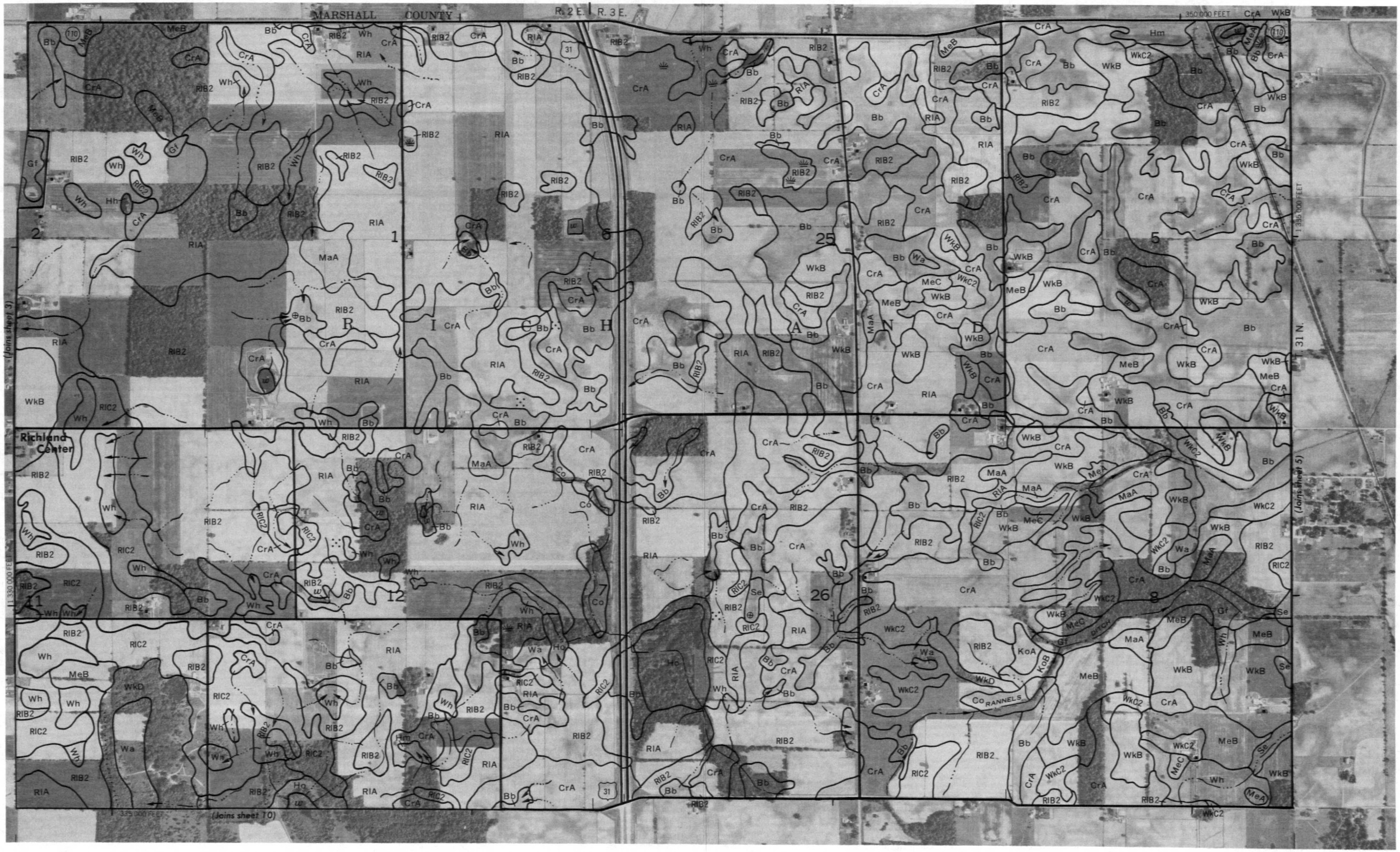
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Muck surface layer

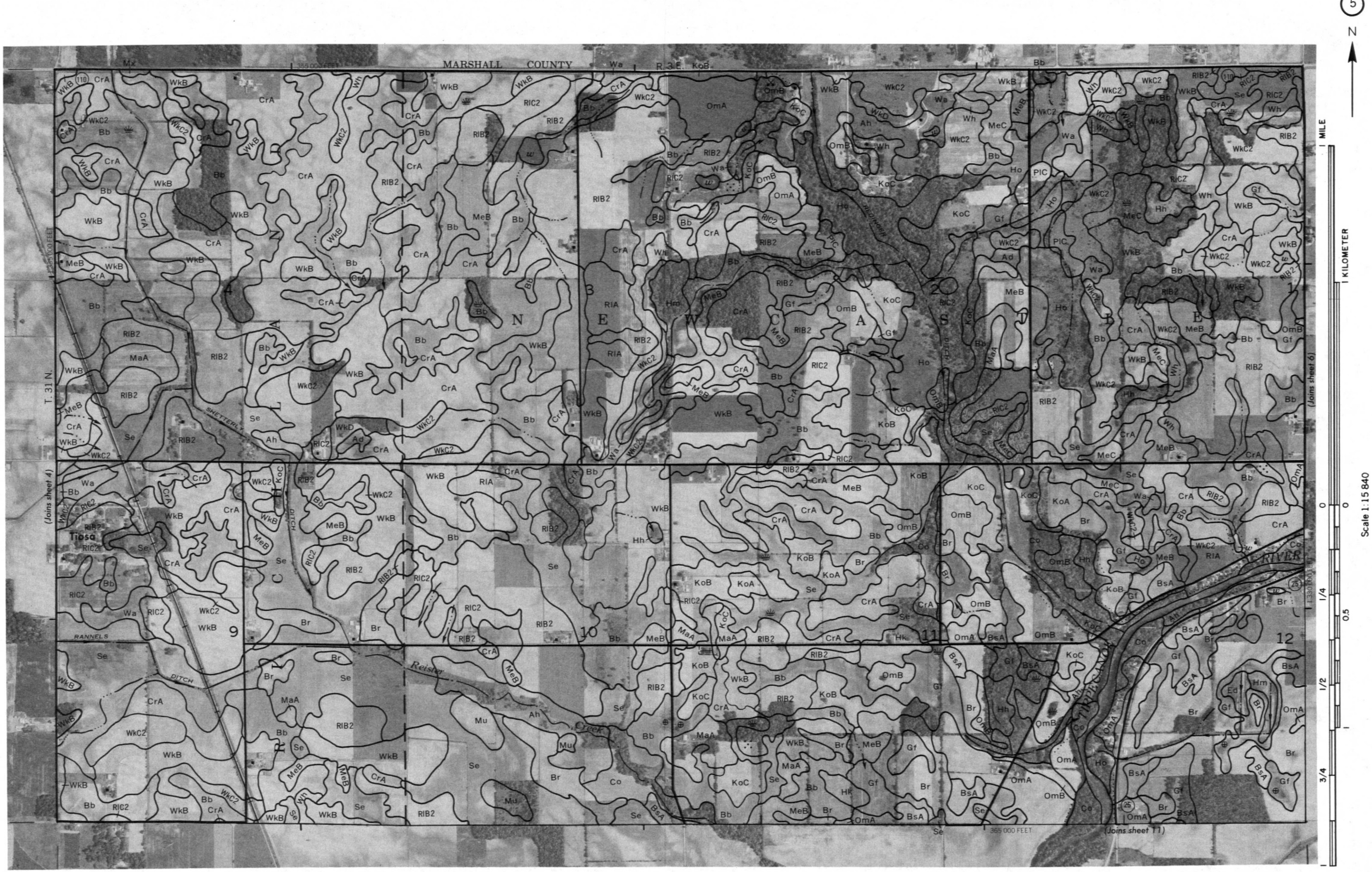

1
N
MARSHALL COUNTY
R. 1 E.
PULASKI COUNTY
T. 31 N.
SECOND PRINCIPAL MERIDIAN
A U B B E E N A U B B E E
TIPPECANOE RIVER
THOMPSON
WILSON DITCH
WAGONER DITCH
COLLINS DITCH
(Joins sheet 2)
(Joins sheet 7)
1 MILE
1 KILOMETER
Scale 1:15 840


2
N
1 MILE
1 KILOMETER
MARSHALL COUNTY
R. 1 E.
R. 2 E.
T. 31 N.
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 8)
AUBBEENAUBBEE
HENRY
COWAN DITCH
COLLINS DITCH
DITCH
315 000 FEET
300 000 FEET
2225 000 FEET
230 000 FEET

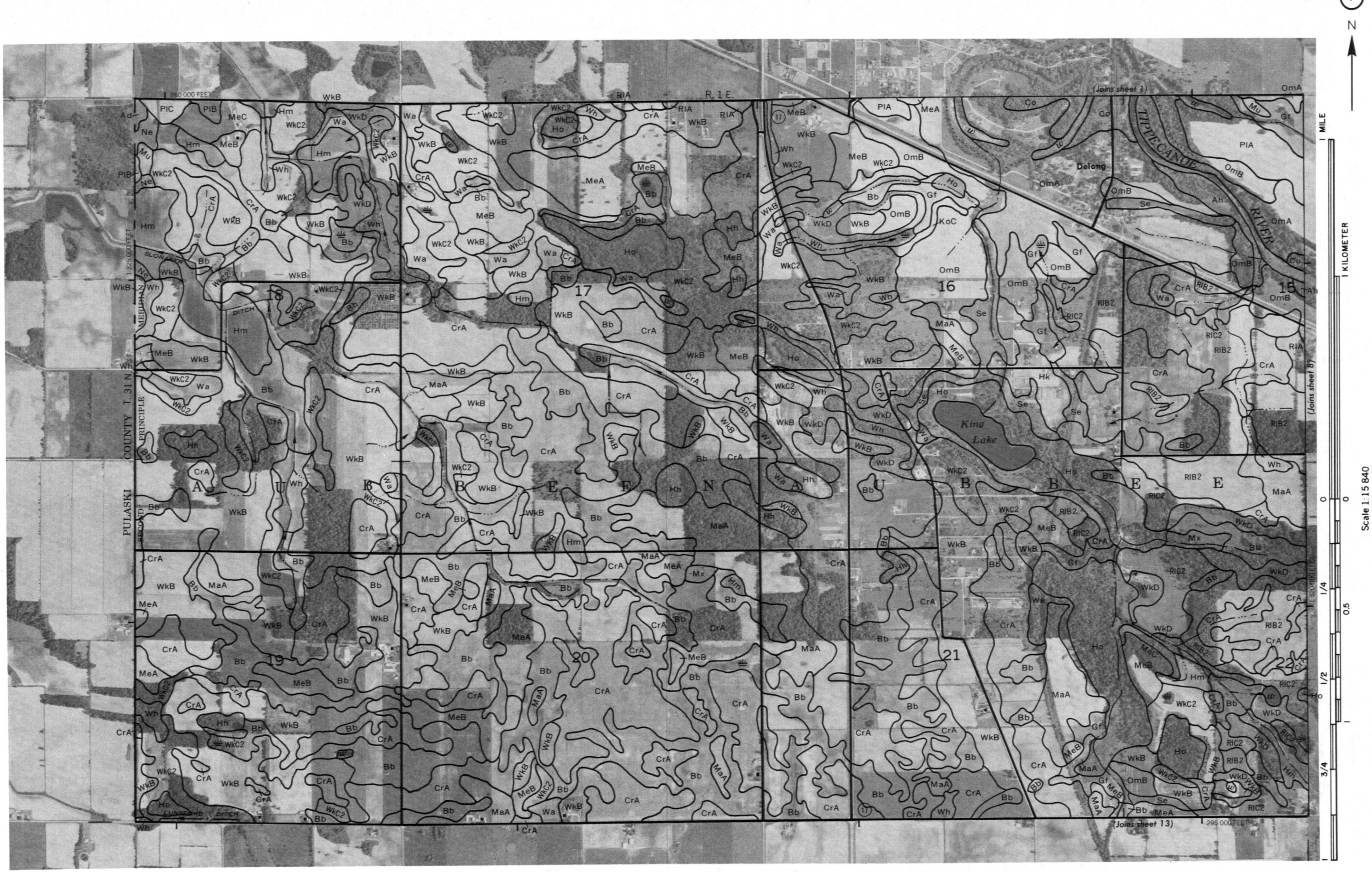

N
R. 2 E.
MARSHALL COUNTY
320 000 FEET
330 000 FEET
T. 31 N.
(Joins sheet 4)
(Joins sheet 2)
(Joins sheet 9)
Eddy Creek
Babcock
Overmyer Ditch
Miller Ditch
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:15 840

FULTON COUNTY, INDIANA — SHEET NUMBER 4

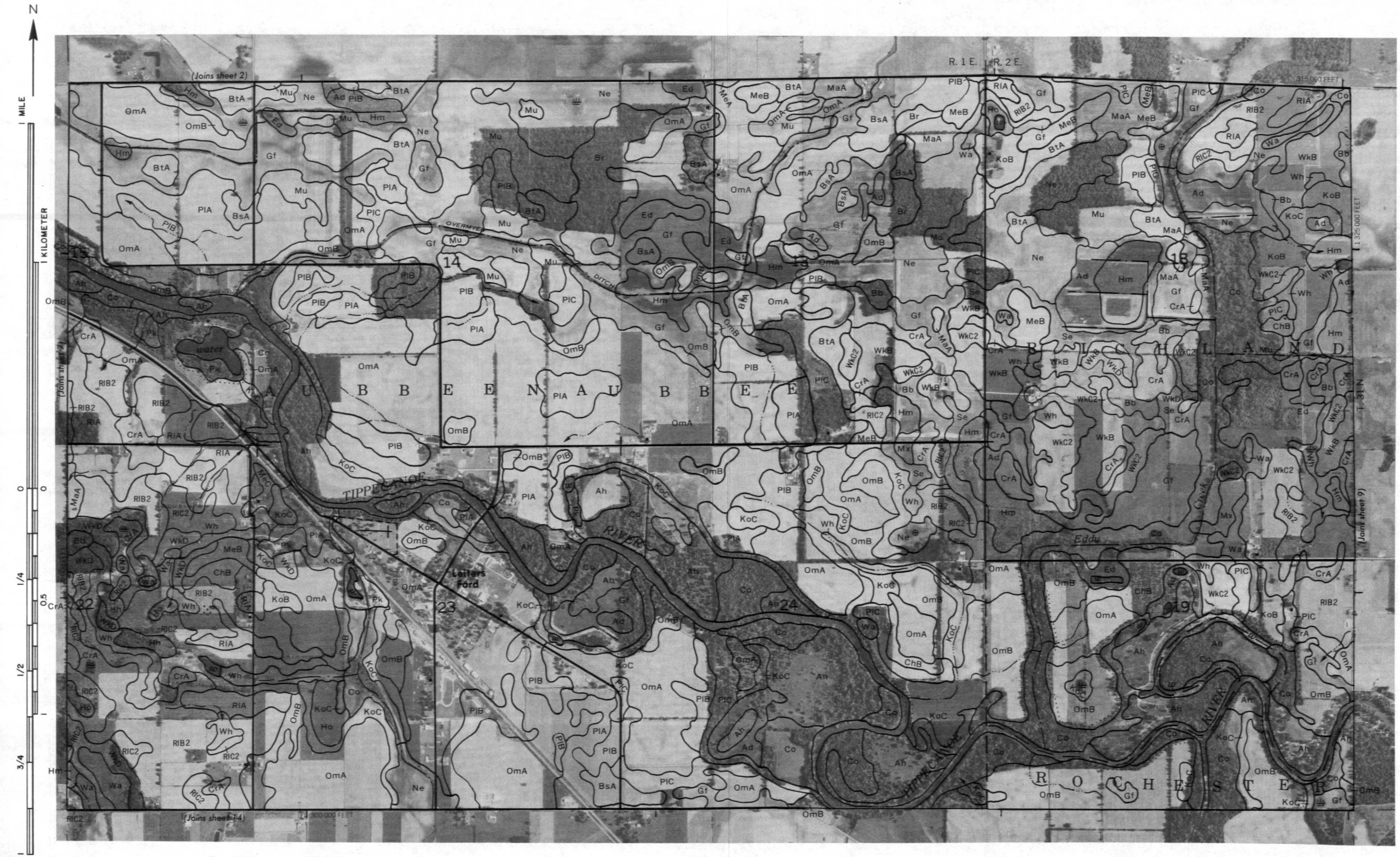


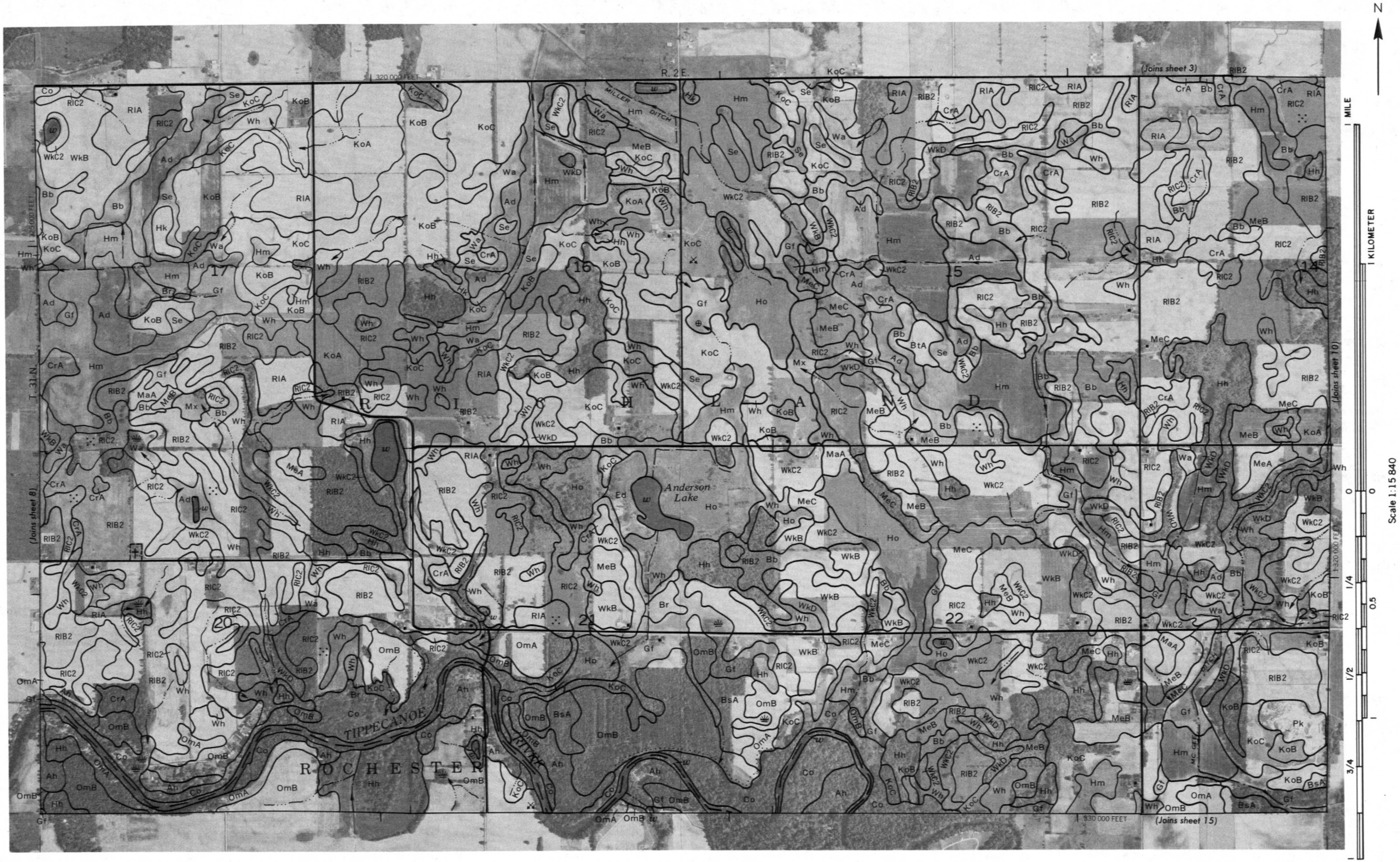

5
N
MARSHALL COUNTY
R. 3 E.
T. 31 N.
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 11)
TIPPECANOE RIVER
Tiosa
SHETTERLY
RANNELS
DITCH
Reister Creek
355 000 FEET
1 MILE
1 KILOMETER
Scale 1:15 840

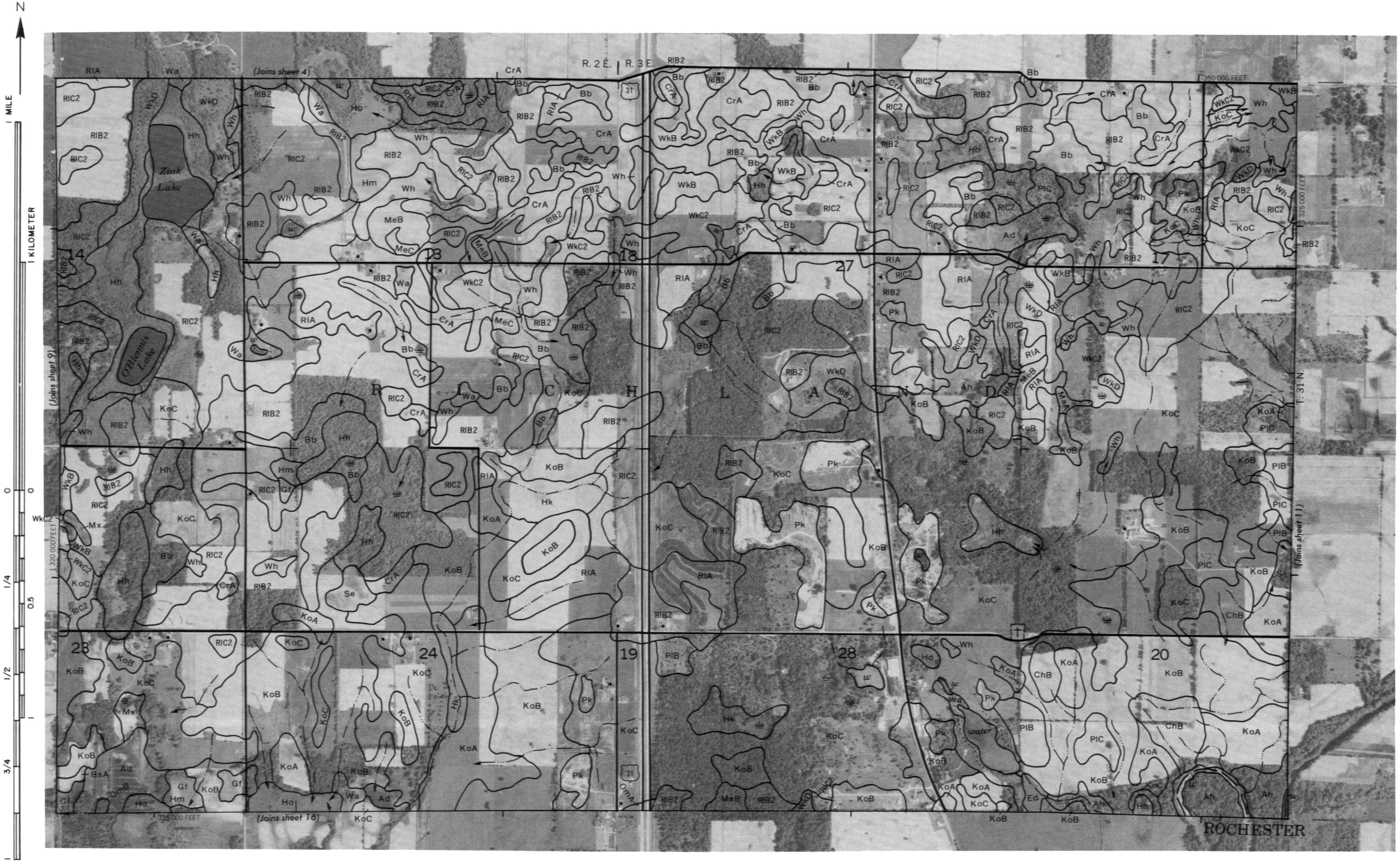

N
1 MILE
1 KILOMETER
MARSHALL COUNTY
R. 3 E. | R. 4 E.
385 000 FEET
370 000 FEET
(Joins sheet 5)
(Joins sheet 12)
KOSCIUSKO COUNTY
T. 31 N.
TIPPECANOE RIVER
Talma
Big Yellow Creek
Little Yellow Creek
BLUE DITCH
BUSENBURG DITCH
MAHONEY DITCH
MARSH
water

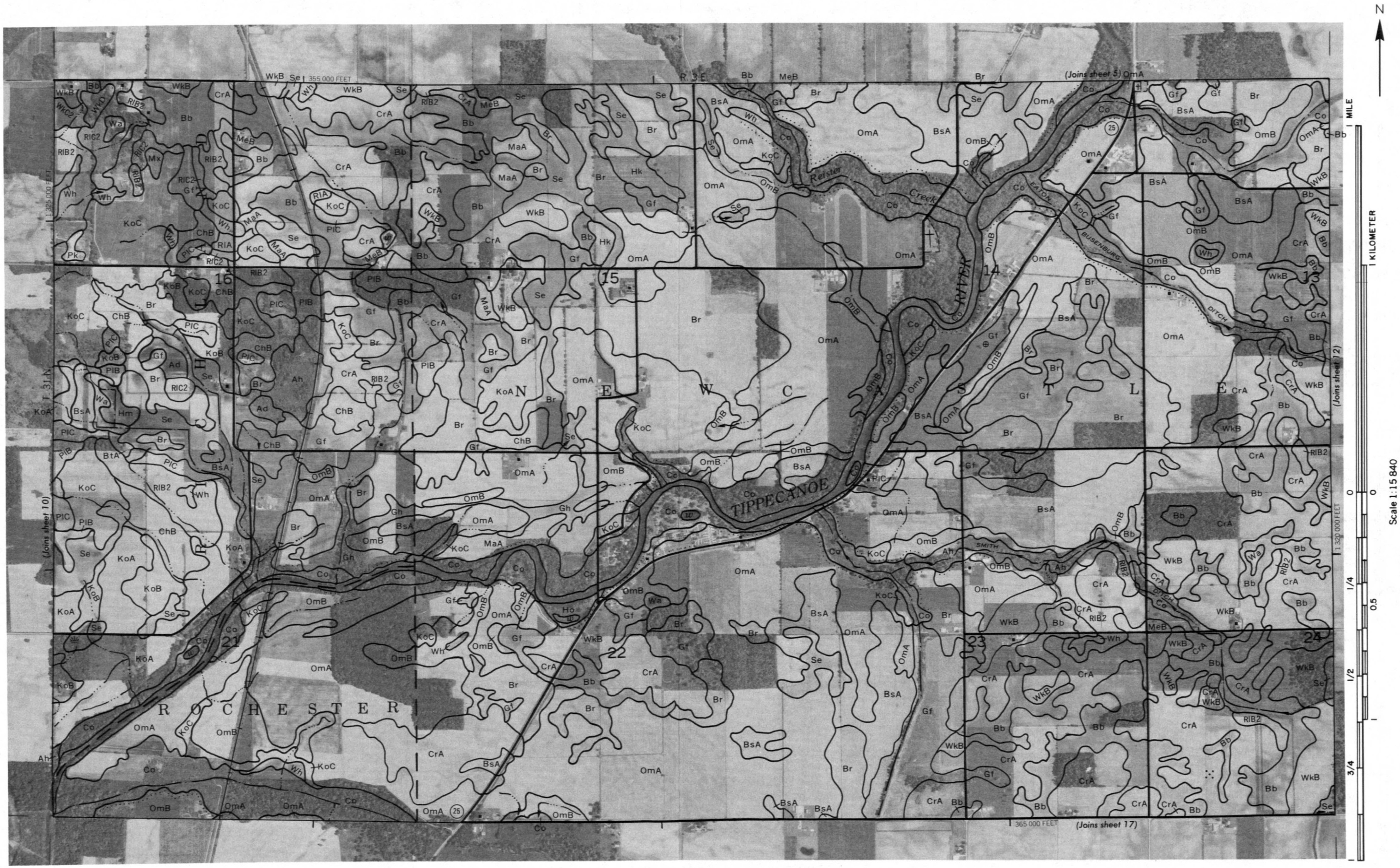

7
N
(Joins sheet 1)
(Joins sheet 8)
(Joins sheet 13)
TIPPECANOE RIVER
Delong
King Lake
PULASKI COUNTY
SECOND PRINCIPLE MERIDIAN
T. 31 N.
R. 1 E.
SLONAKER DITCH
LUNSFORD DITCH
FULAUBBEE NAUBBEE
1 MILE
1 KILOMETER
Scale 1:15 840

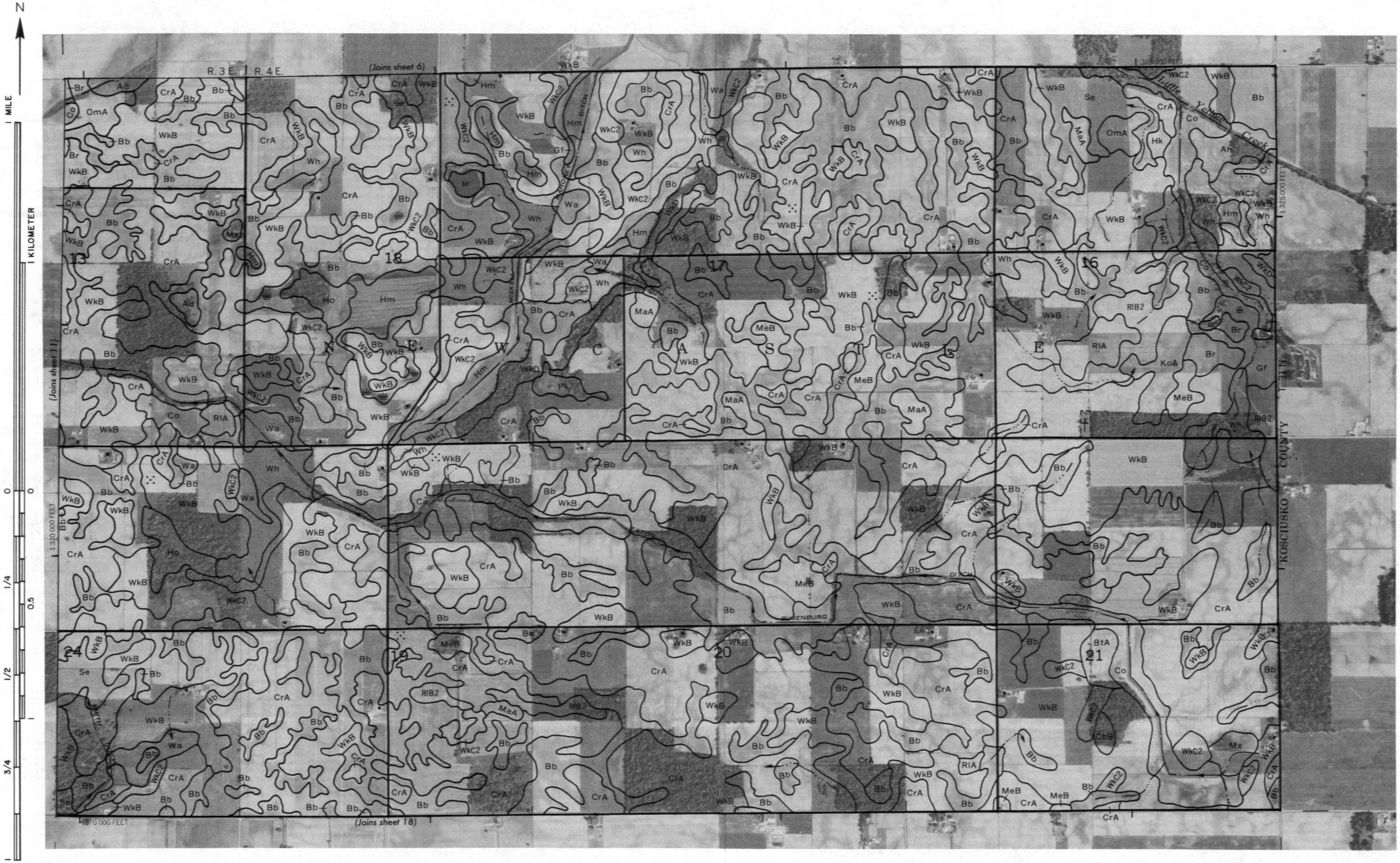
FULTON COUNTY, INDIANA — SHEET NUMBER 8

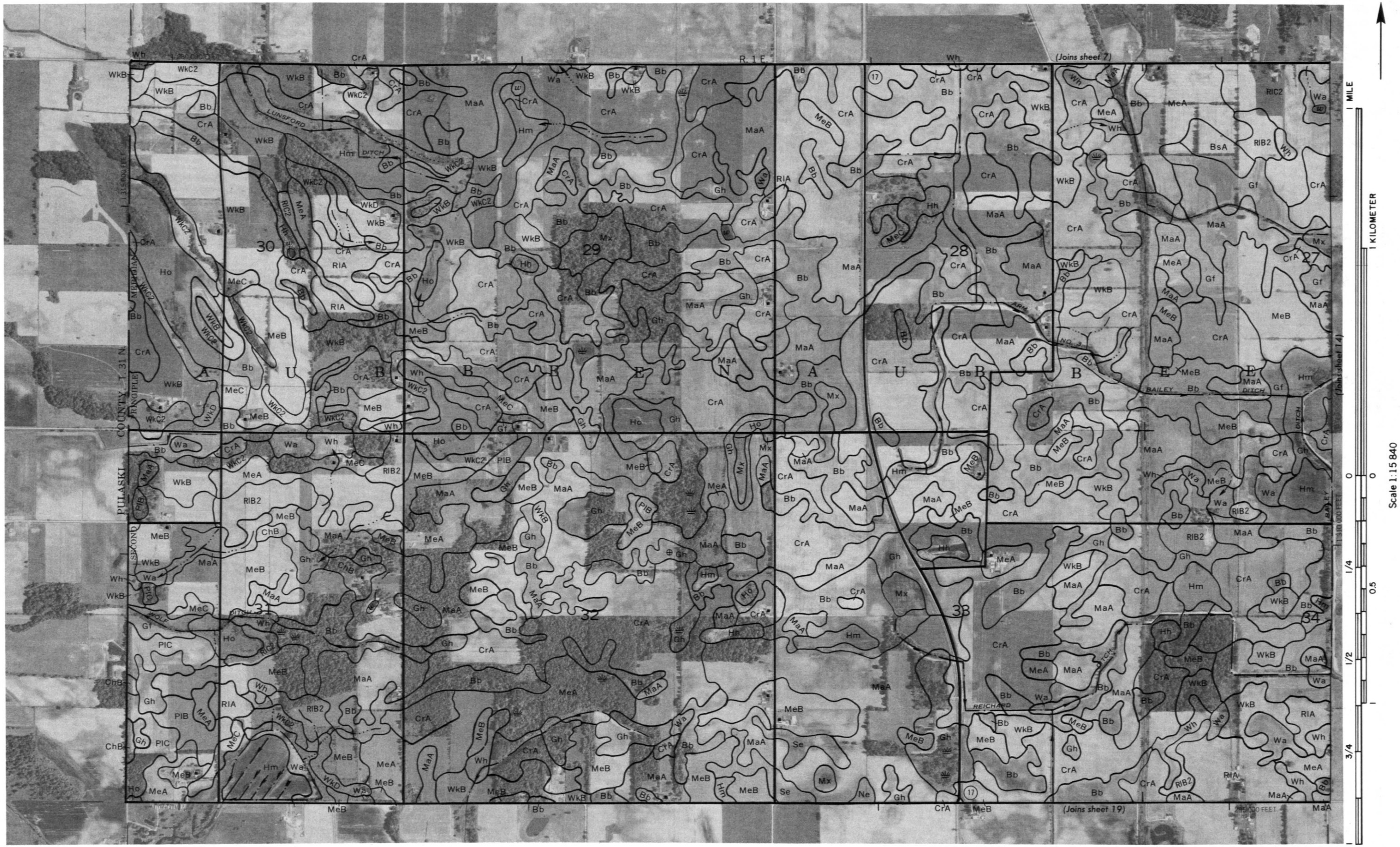


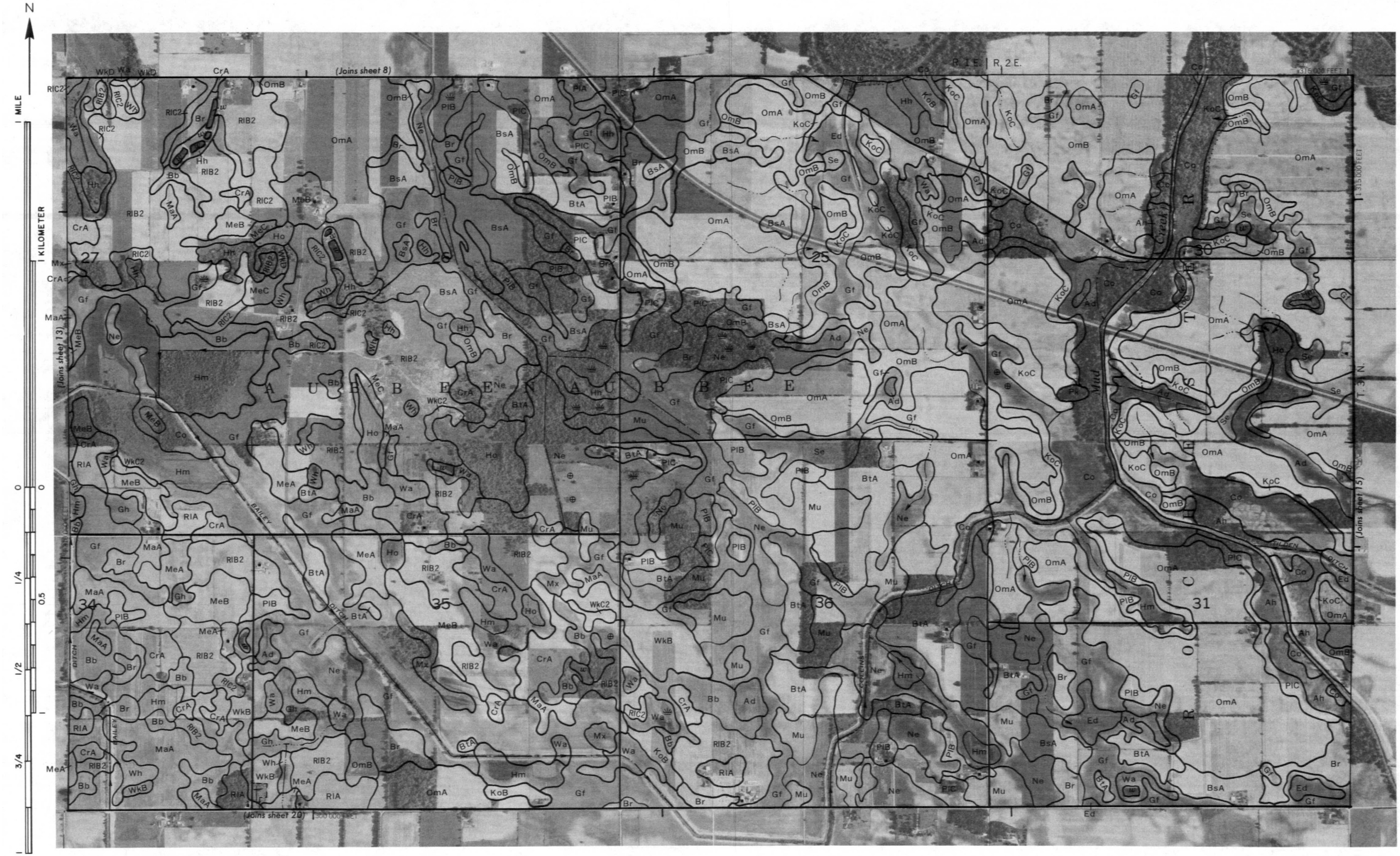

N
(Joins sheet 3)
(Joins sheet 10)
(Joins sheet 15)
(Joins sheet 8)
R. 2 E.
T. 31 N.
MILLER DITCH
Anderson Lake
TIPPECANOE
RIVER
ROCHESTER
17
16
15
14
20
21
22
23
320 000 FEET
330 000 FEET
1 320 000 FEET
1 325 000 FEET
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5


N
1 MILE
1 KILOMETER
0
1/4
0.5
1/2
3/4
1
(Joins sheet 4)
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 16)
R. 2 E.
R. 3 E.
T. 31 N.
Zink Lake
O'Blennis Lake
ROCHESTER
RICHLAND
350 000 FEET
325 000 FEET
320 000 FEET
335 000 FEET
14
13
18
17
27
23
24
19
28
20
31

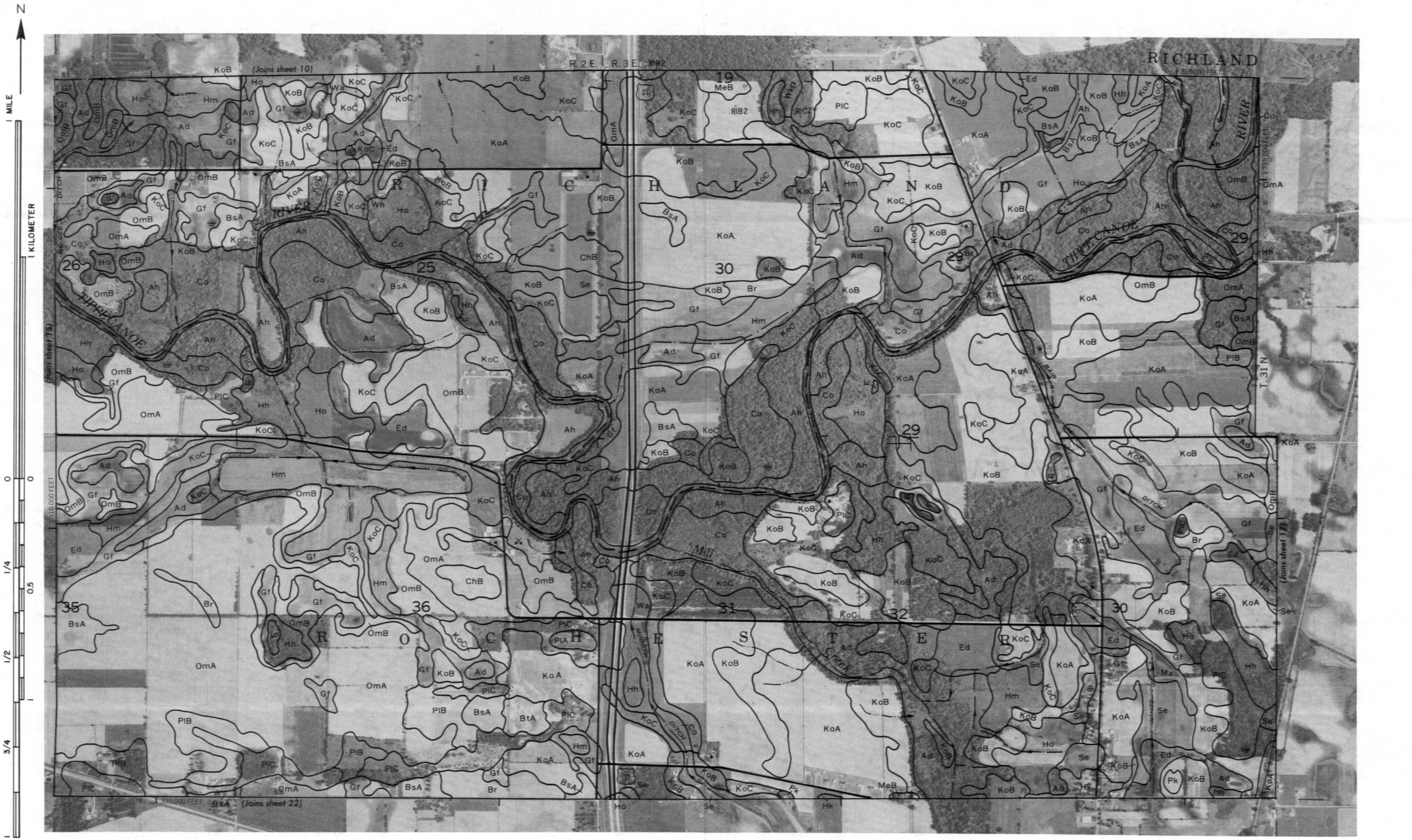

N
(Joins sheet 5)
(Joins sheet 10)
(Joins sheet 12)
(Joins sheet 17)
R. 3 E.
T. 31 N.
355 000 FEET
365 000 FEET
385 000 FEET
320 000 FEET
Reister Creek
EATON BUSENBURG DITCH
SMITH DITCH
TIPPECANOE RIVER
NEWCASTLE
ROCHESTER
13
14
15
16
21
22
23
24
25
1 MILE
KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:15 840

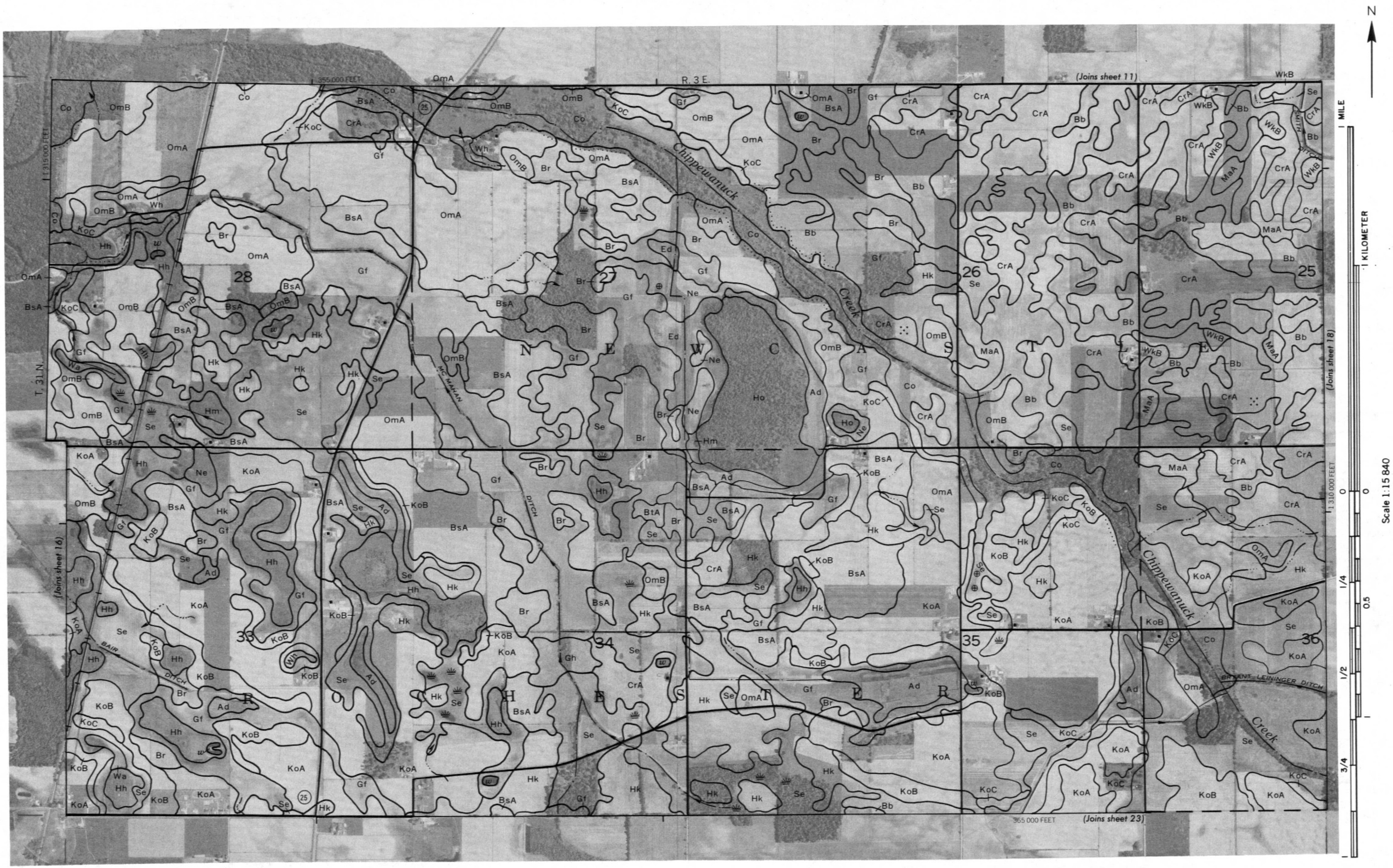

N
MILE
KILOMETER
R. 3 E.
R. 4 E.
(Joins sheet 6)
(Joins sheet 11)
(Joins sheet 18)
T. 31 N.
KOSCIUSKO COUNTY
NEWCASTLE
Little Yellow Creek
365 000 FEET
370 000 FEET
1 320 000 FEET
1 325 000 FEET
13
18
17
16
24
19
20
21

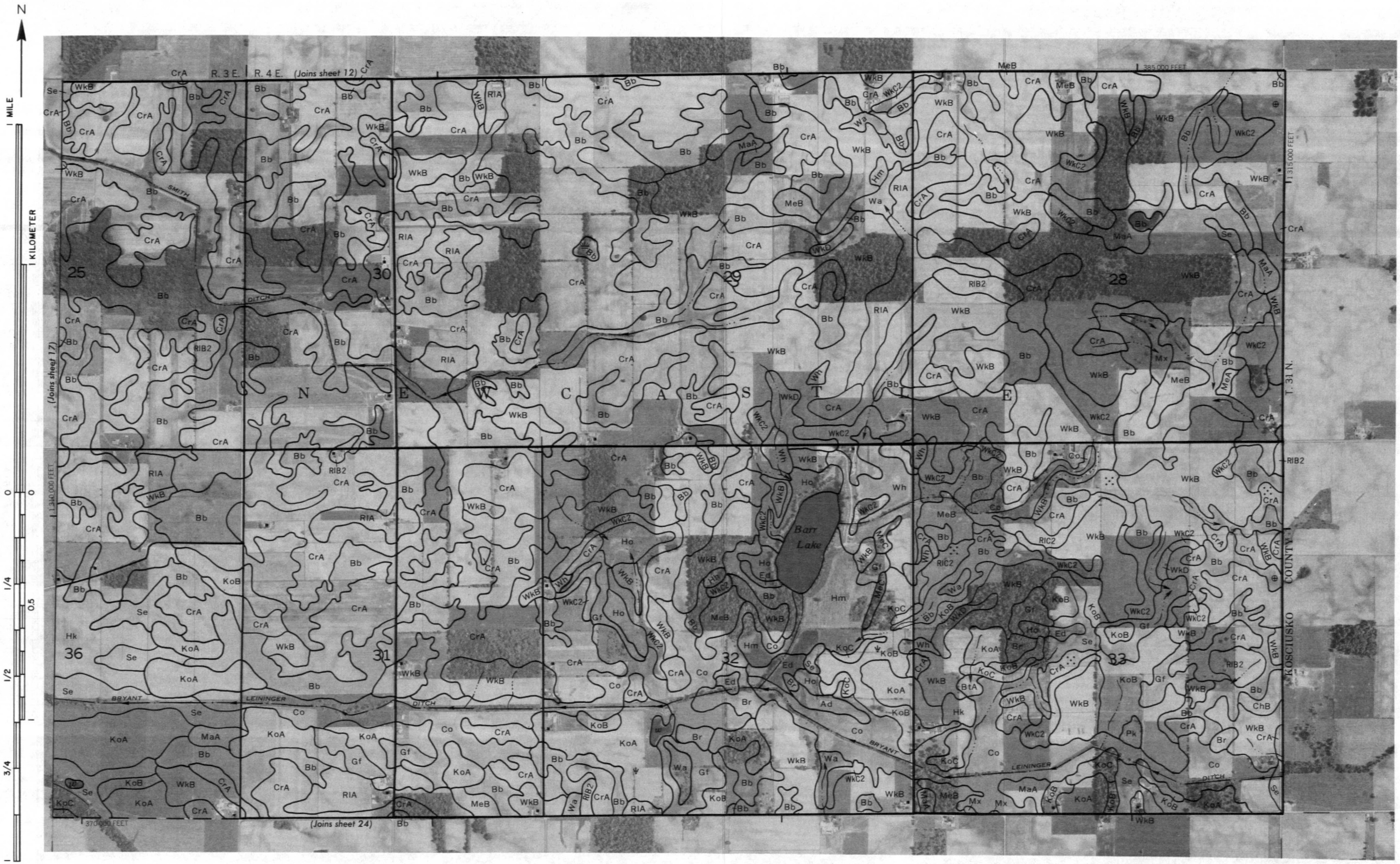

(Joins sheet 7)
(Joins sheet 14)
(Joins sheet 19)
R. 1 E.
T. 31 N.
PULASKI COUNTY
A U B B E E N A U B B E E
LUNSFORD DITCH
ARM NO. 3
BAILEY DITCH
REICHARD
WOLF DITCH
SECOND PRINCIPLE MERIDIAN
30
29
28
27
31
32
33
34
N
1 MILE
1 KILOMETER
0
1/4
0.5
1/2
3/4
Scale 1:15 840

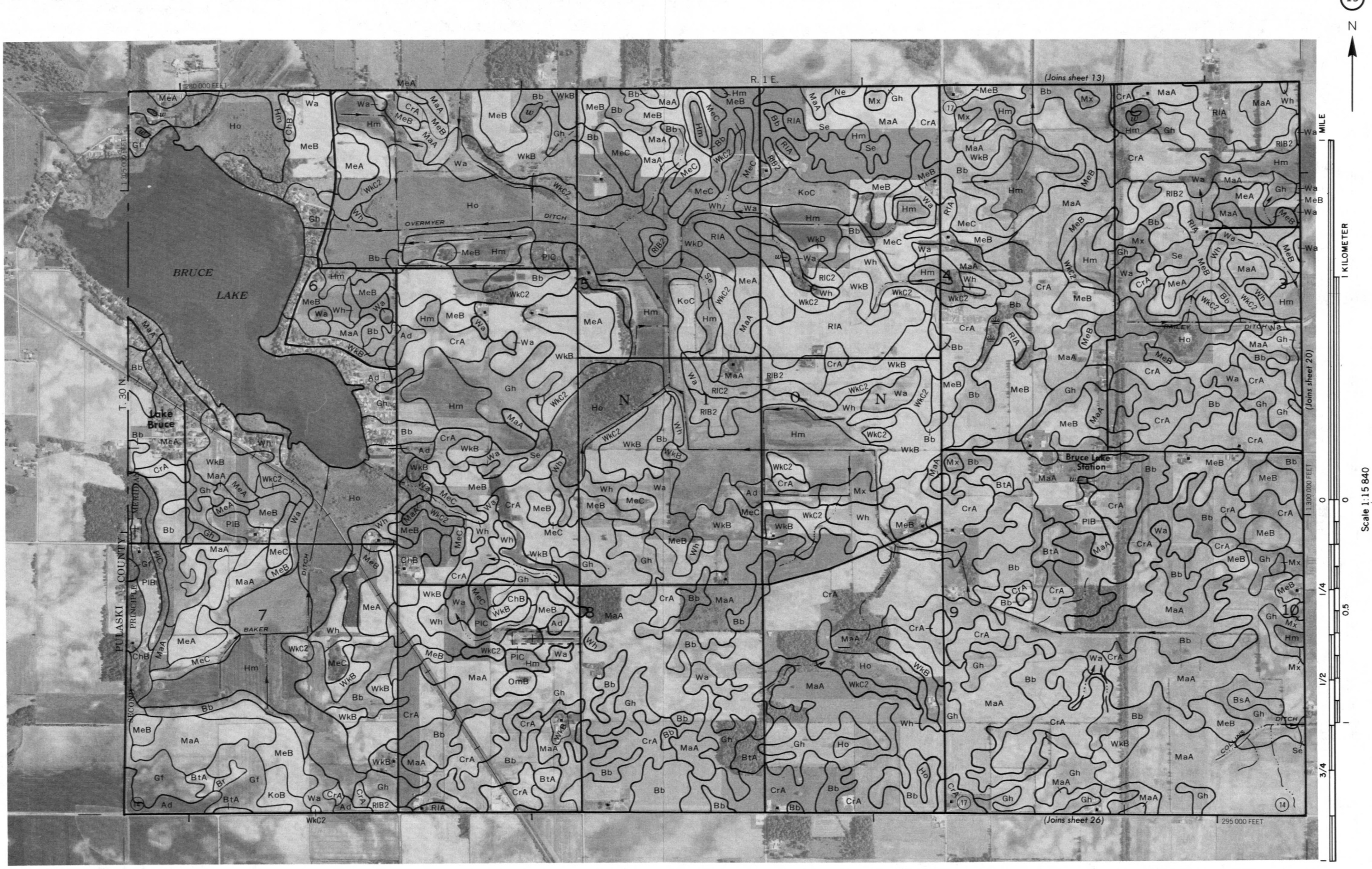

N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
(Joins sheet 8)
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 20)
R. 1 E. | R. 2 E.
T. 31 N.
A U B B E E N A U B B E E
R O C H E S T E R
Mud Creek
BAILEY DITCH
TILDEN DITCH
27
26
25
30
34
35
36
31


N
(Joins sheet 9)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 21)
R. 2 E.
T. 31 N.
TIPPECANOE RIVER
RICHLAND
ROCHESTER
Pershing
TILDEN DITCH
MATHIAS DITCH
ALLEN DITCH
Mud Creek
water
320 000 FEET
330 000 FEET
310 000 FEET
1 MILE
1 KILOMETER
Scale 1:15 840


N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
(Joins sheet 10)
(Joins sheet 22)
(Joins sheet 15)
(Joins sheet 17)
R. 2 E. | R. 3 E.
T. 31 N.
RICHLAND
TIPPECANOE RIVER
Mill Creek
ROCHESTER
19
25
26
29
30
31
32
35
36

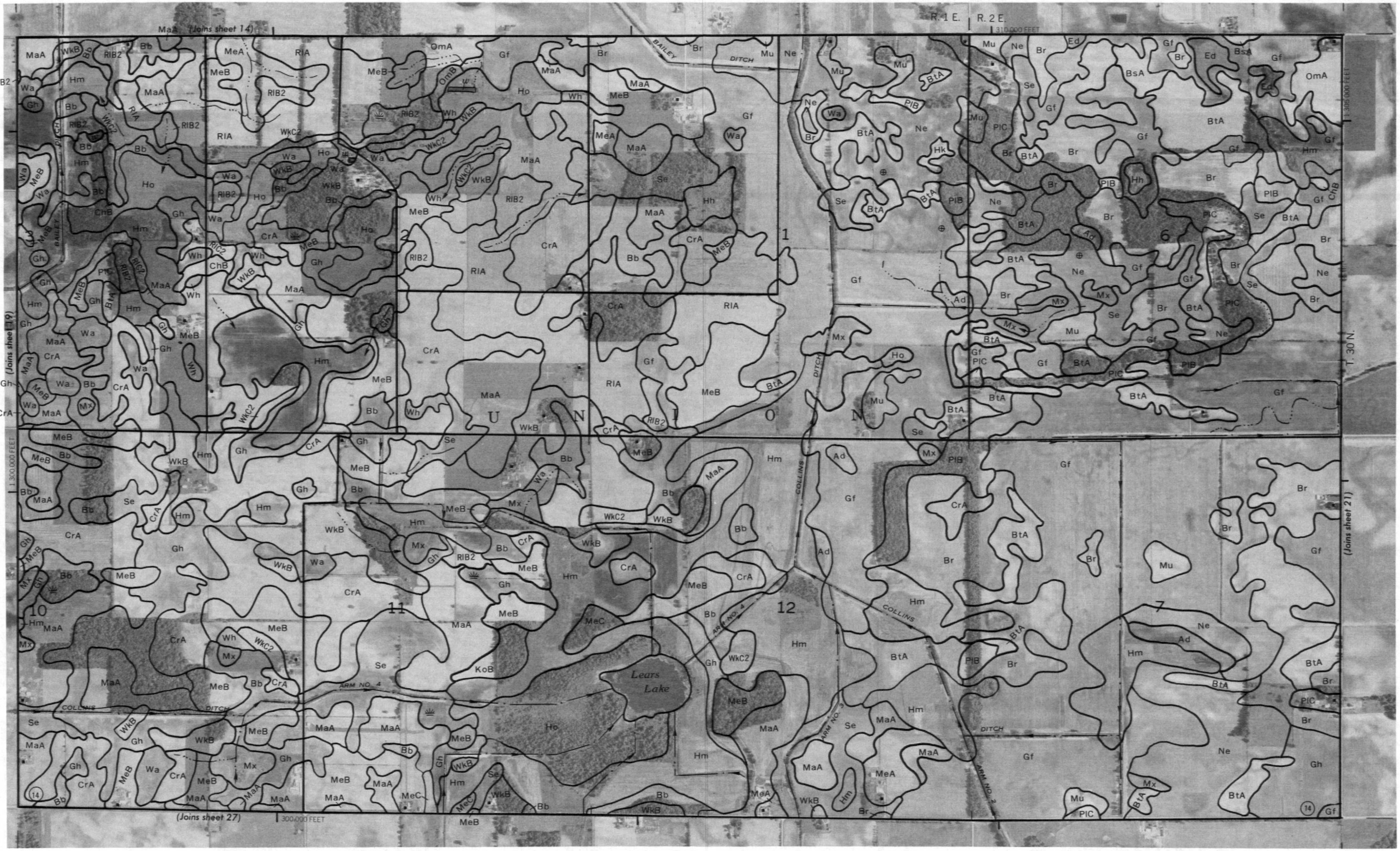

(Joins sheet 11)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 23)
R. 3 E.
T. 31 N.
355 000 FEET
365 000 FEET
1 315 000 FEET
1 310 000 FEET
Chippewanuck Creek
NEWCASTLE
ROCHESTER
MC MAHAN
DITCH
BAIR DITCH
BRYANT LEININGER DITCH
25
26
27
28
33
34
35
36
N
MILE
KILOMETER
0
1/4
1/2
3/4
0.5
1
Scale 1:15 840


N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0
0.5
1
R. 3 E.
R. 4 E.
(Joins sheet 12)
(Joins sheet 17)
(Joins sheet 24)
385 000 FEET
1 315 000 FEET
1 310 000 FEET
370 000 FEET
T. 31 N.
KOSCIUSKO COUNTY
N E W C A S T L E
SMITH
DITCH
BRYANT
LEININGER
DITCH
Barr Lake
25
30
29
28
36
31
32
33

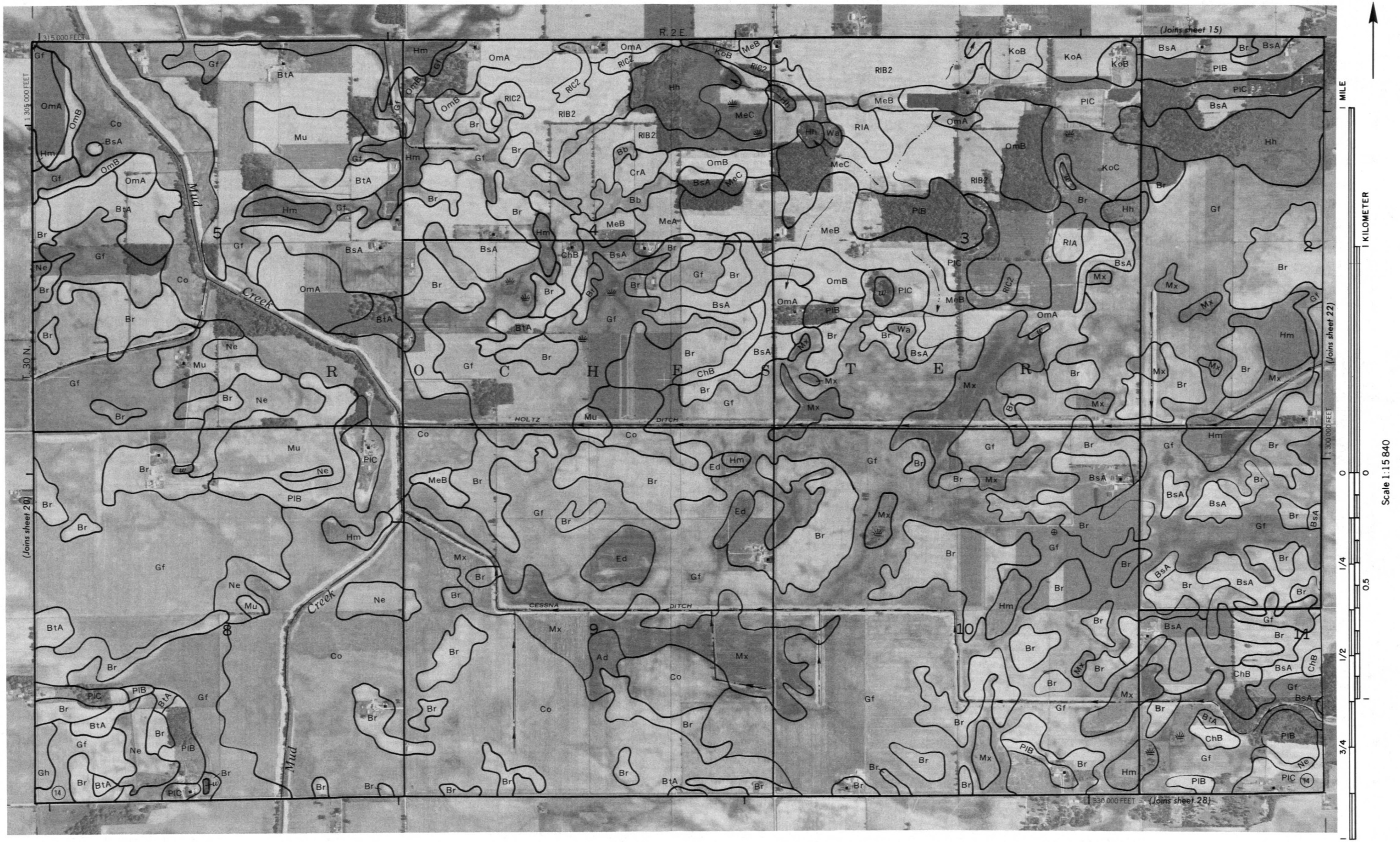


(Joins sheet 13)
R. 1 E.
280 000 FEET
1 305 000 FEET
BRUCE LAKE
Lake Bruce
T. 30 N.
PULASKI COUNTY
SECOND PRINCIPAL MERIDIAN
OVERMYER DITCH
BAKER DITCH
BAILEY DITCH
COLLINS DITCH
UNION
Bruce Lake Station
(Joins sheet 20)
(Joins sheet 26)
295 000 FEET
1 300 000 FEET
N
1 MILE
1 KILOMETER
Scale 1:15 840

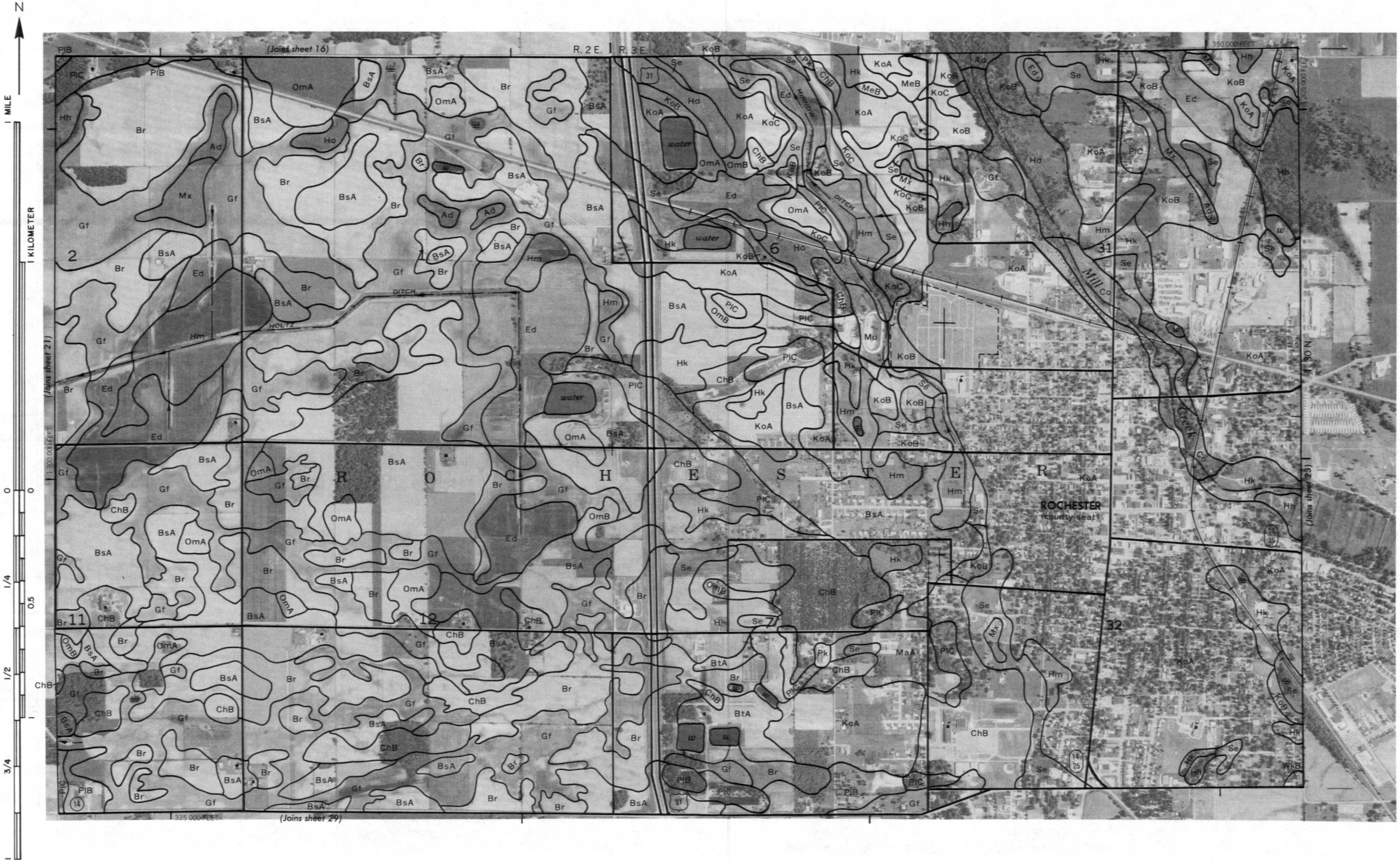
N



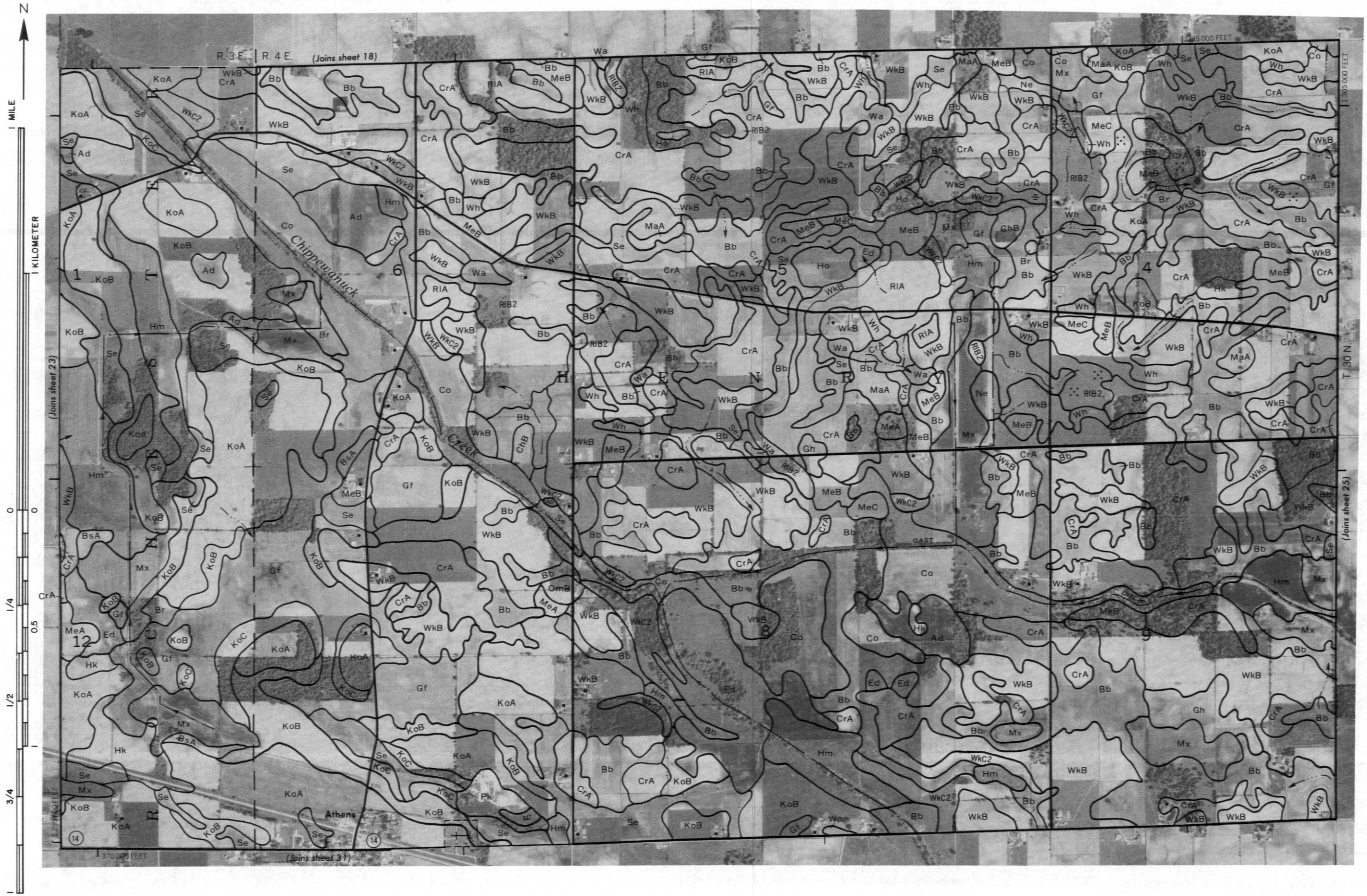
1 MILE
1 KILOMETER
0 1/4 1/2 3/4 1
0 0.5 1

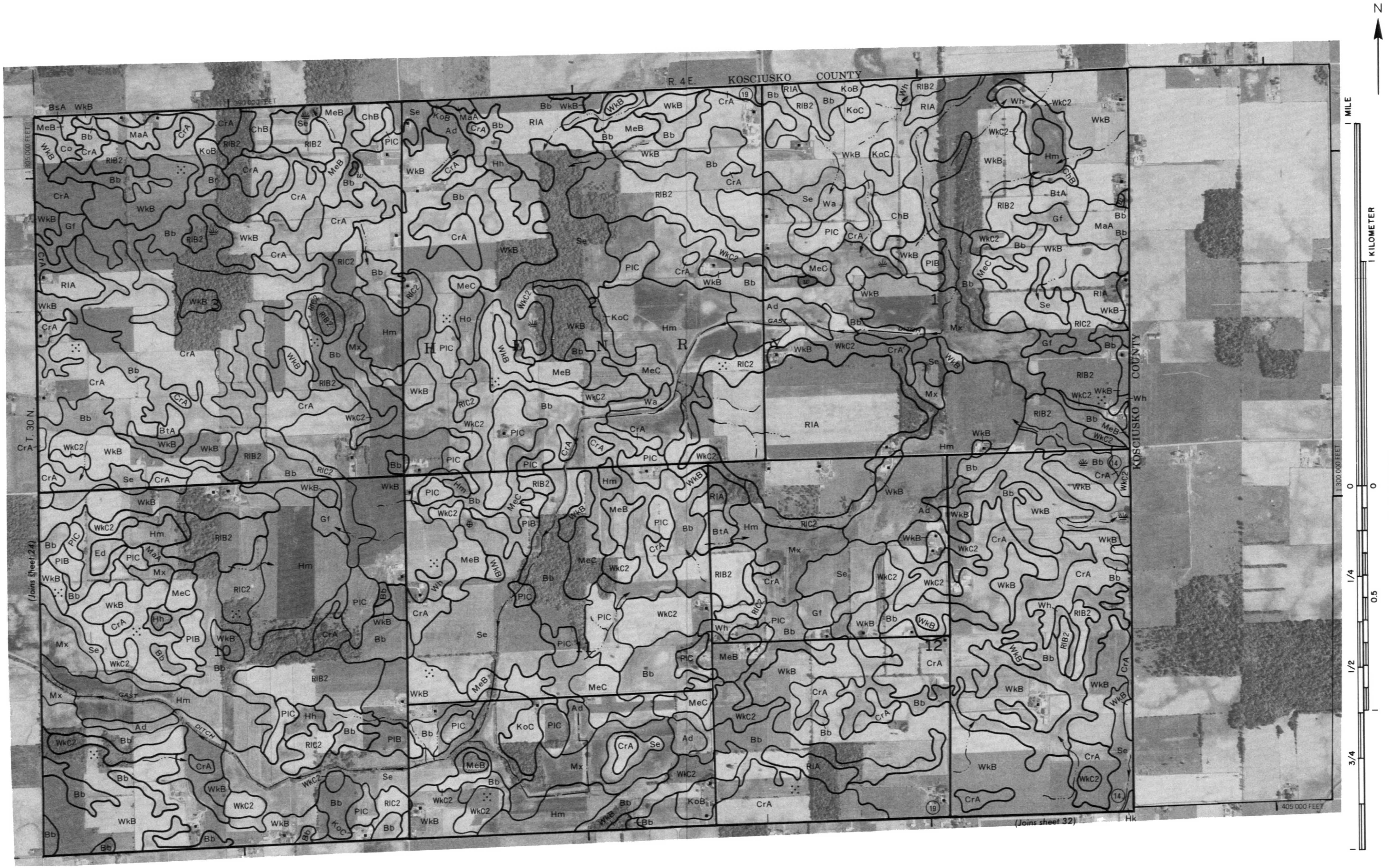

(Joins sheet 15)
(Joins sheet 22)
(Joins sheet 28)
(Joins sheet 20)
R. 2 E.
T. 30 N.
ROCHESTER
Mud Creek
HOLTZ DITCH
CESSNA DITCH
N
1 MILE
1 KILOMETER
Scale 1:15 840

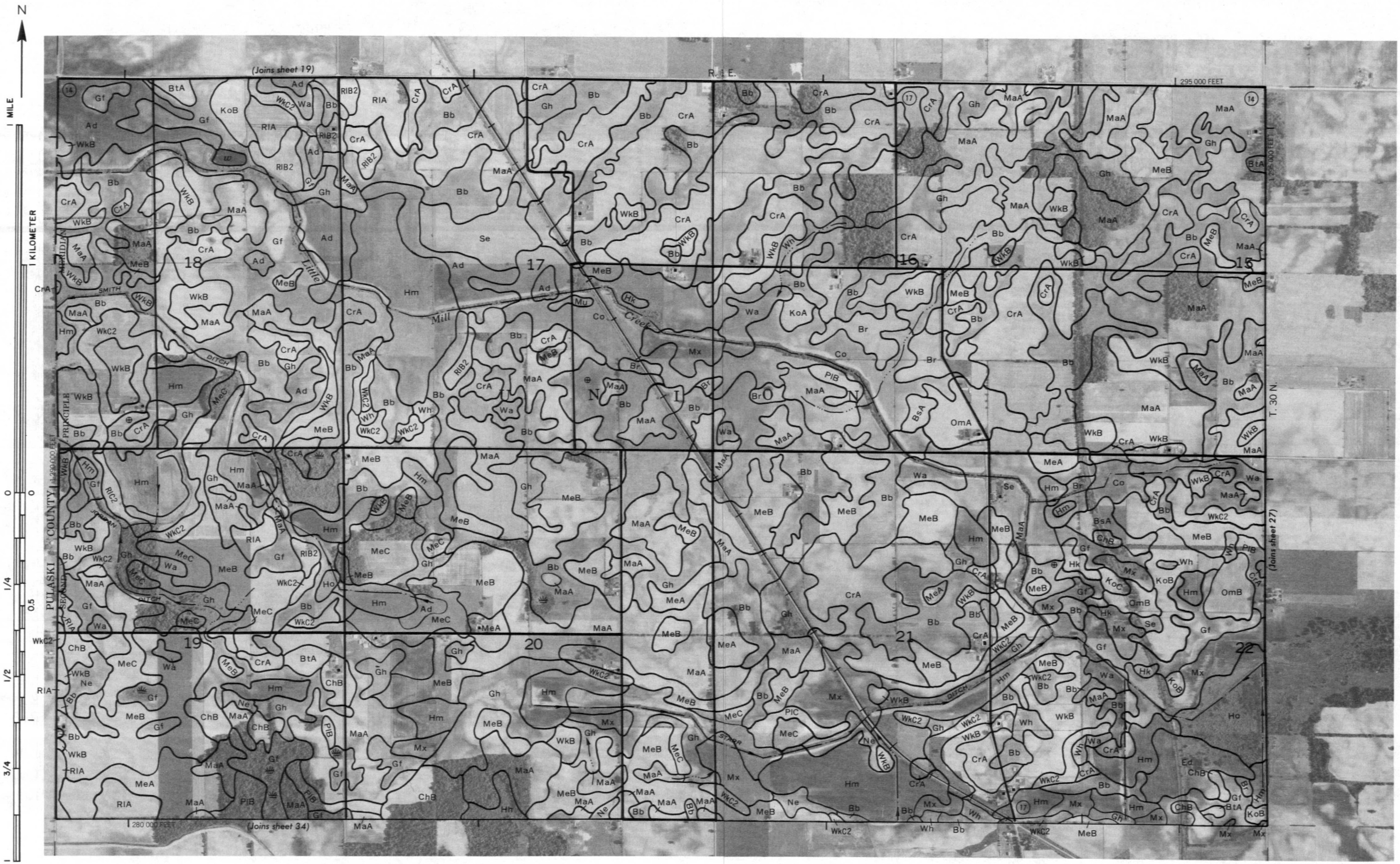
FULTON COUNTY, INDIANA — SHEET NUMBER 22

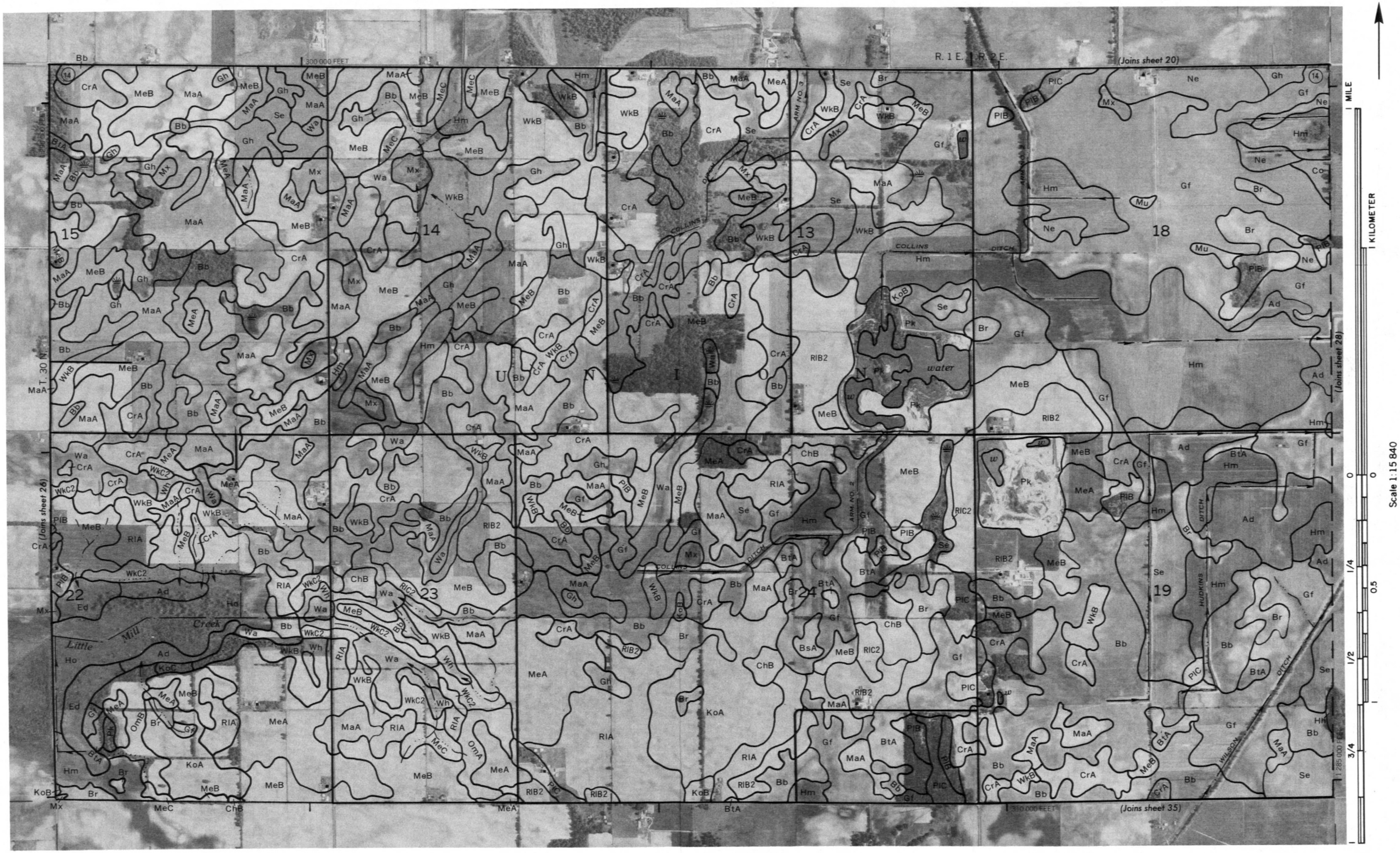


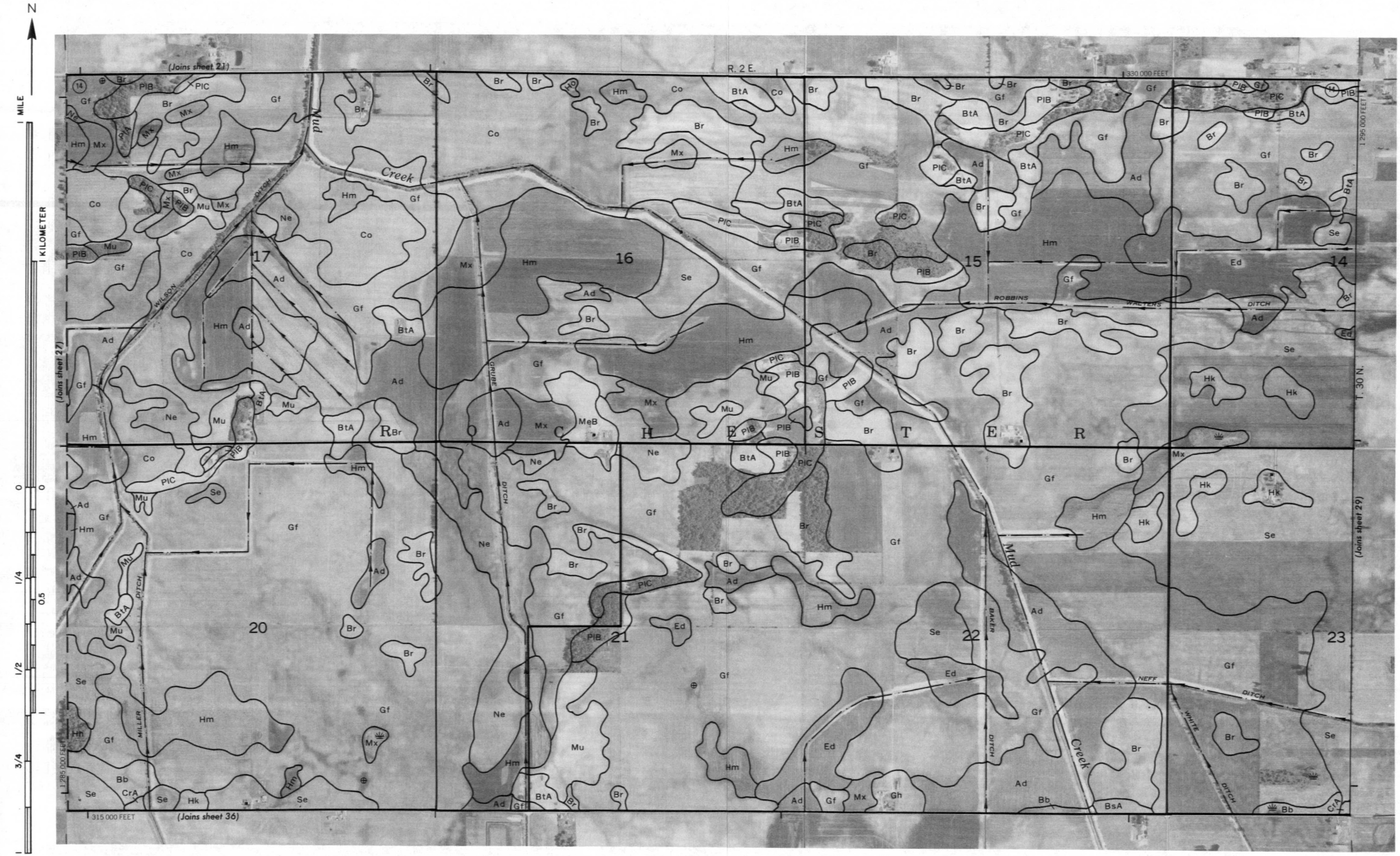

23
N
(Joins sheet 17)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 30)
R. 3 E.
T. 30 N.
355 000 FEET
365 000 FEET
1 295 000 FEET
ROCHESTER
(county seat)
LAKE MANITOU
Rochester
Municipal
Airport
R O C H E S T E R
1 MILE
1 KILOMETER
Scale 1:15 840


N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0
0.5
1
R. 3 E.
R. 4 E.
(Joins sheet 18)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 31)
T. 30 N.
395 000 FEET
370 000 FEET
Chippewanuck
Creek
Athens
GAST
FULTON
HENRY


N
R. 4 E.
KOSCIUSKO COUNTY
T. 30 N.
(Joins sheet 24)
(Joins sheet 32)
HENRY
GAST DITCH
1 300 000 FEET
405 000 FEET
390 000 FEET
1 305 000 FEET
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

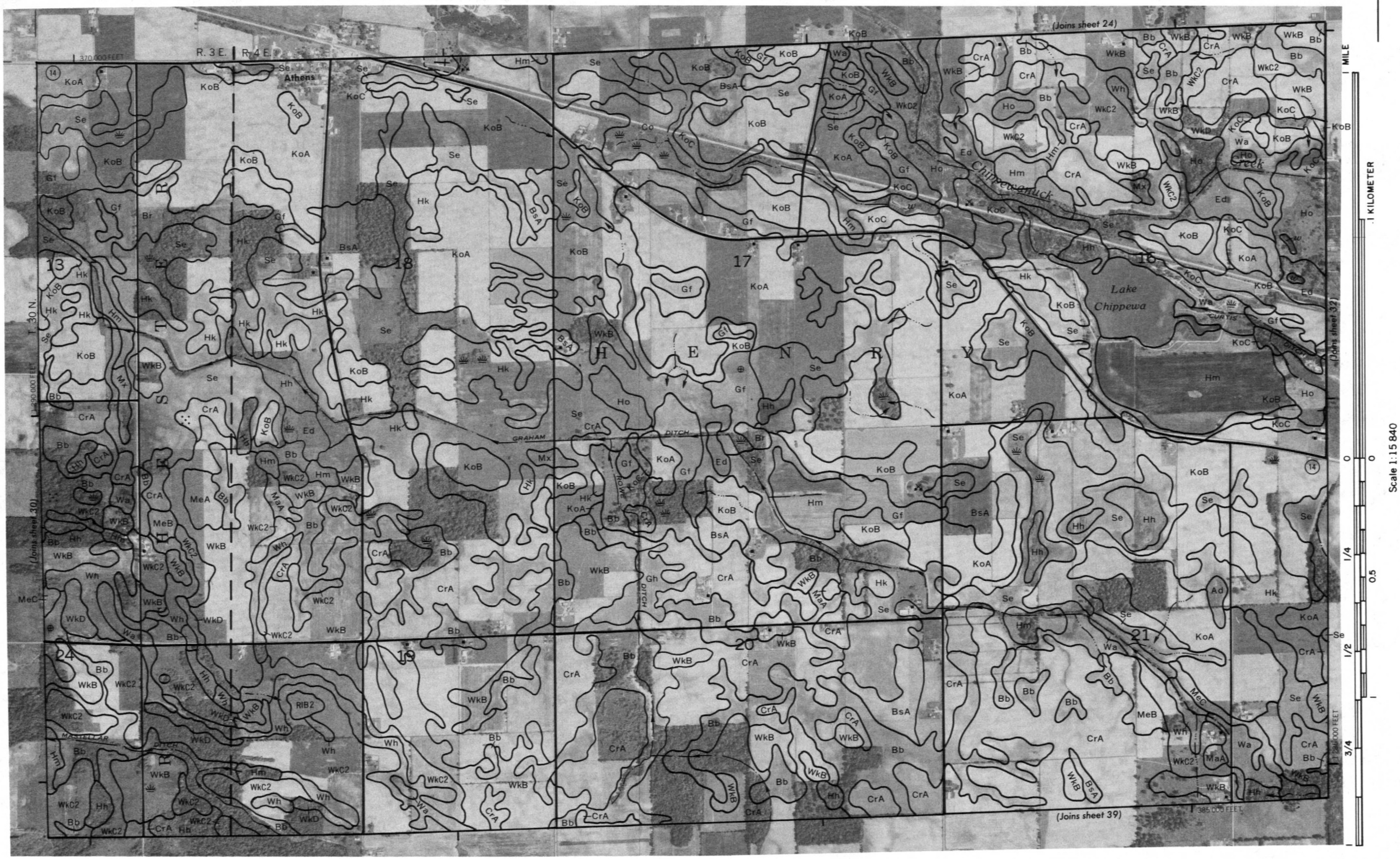

N
1 MILE
1 KILOMETER
(Joins sheet 19)
(Joins sheet 34)
(Joins sheet 27)
R. 1 E.
T. 30 N.
295 000 FEET
280 000 FEET
UNION
PULASKI COUNTY
SECOND PRINCIPAL MERIDIAN
Little Mill Creek
SMITH DITCH
18
17
16
15
19
20
21
22

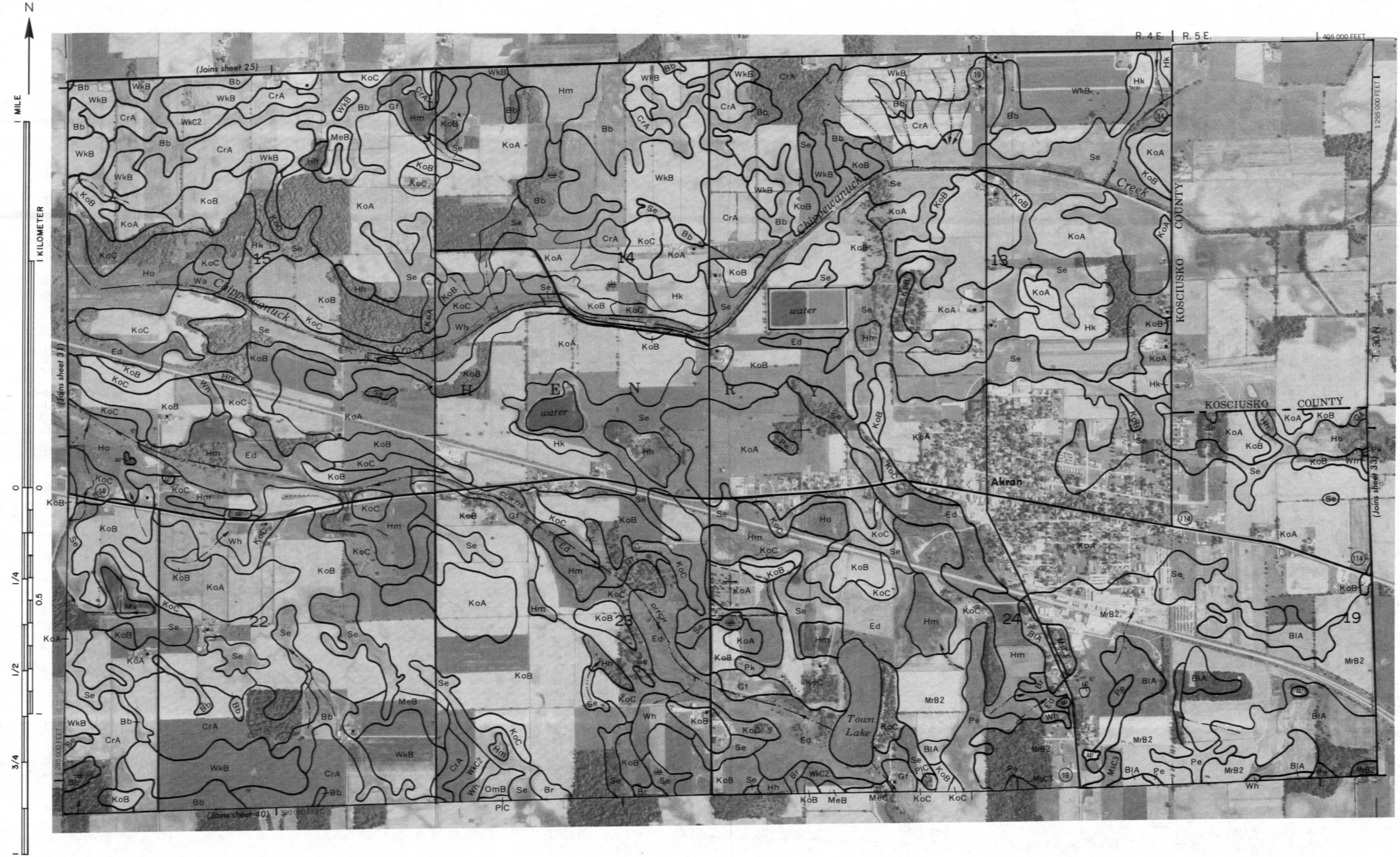

N
(Joins sheet 20)
(Joins sheet 28)
(Joins sheet 35)
(Joins sheet 26)
R. 1 E. | R. 2 E.
T. 30 N.
1 MILE
1 KILOMETER
Scale 1:15 840
COLLINS DITCH
ARM NO. 3
ARM NO. 2
HUDKINS DITCH
WILSON DITCH
Little Mill Creek
UNION
water
15
14
13
18
22
23
24
19

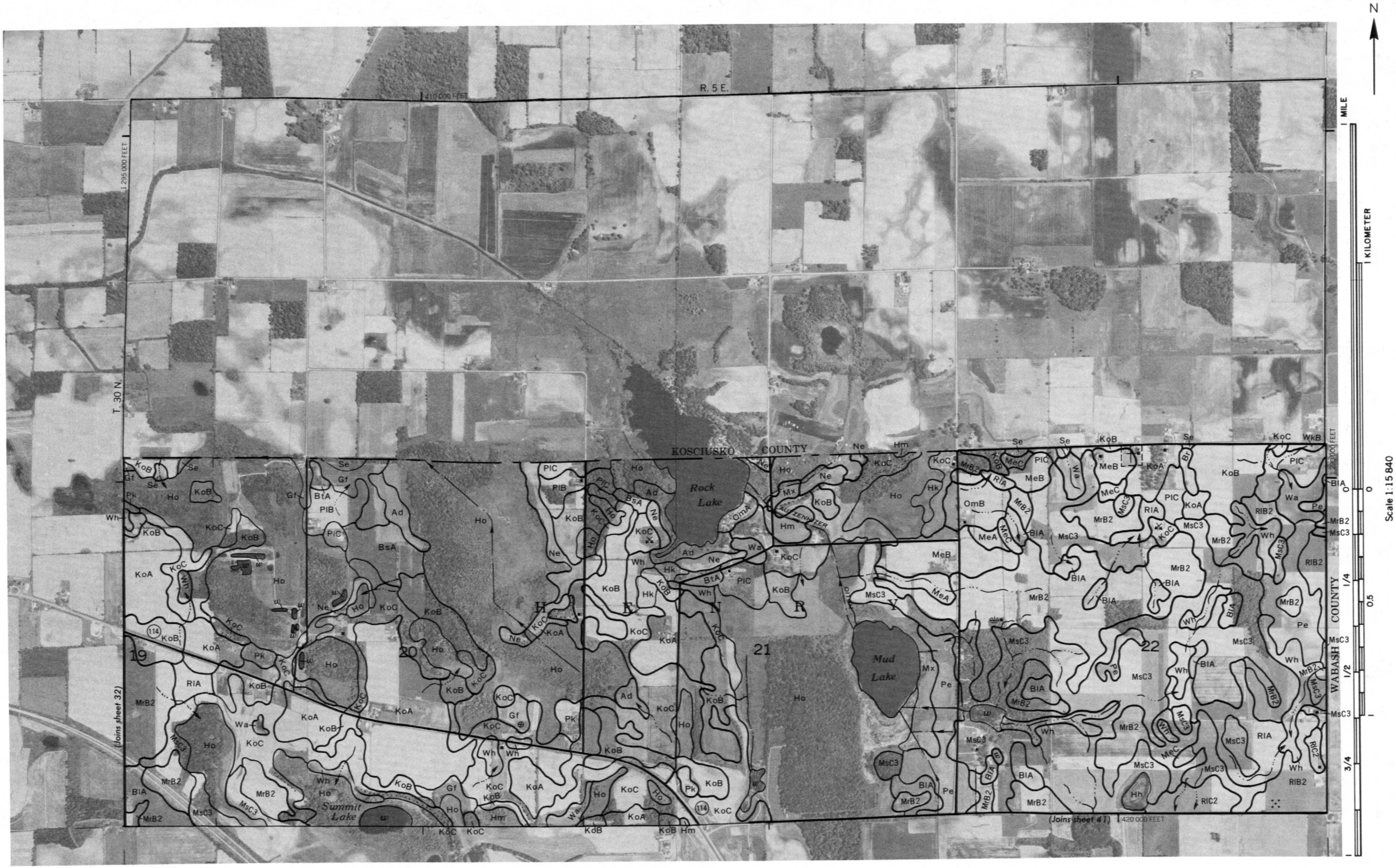

N
1 MILE
1 KILOMETER
(Joins sheet 21)
R. 2 E.
330 000 FEET
1 295 000 FEET
(Joins sheet 27)
(Joins sheet 29)
T. 30 N.
(Joins sheet 36)
315 000 FEET
1 285 000 FEET
Mud Creek
WILSON DITCH
GRUBE DITCH
MILLER DITCH
ROBBINS WALTERS DITCH
BAKER DITCH
NEFF DITCH
WHITE DITCH
R O C H E S T E R
14
15
16
17
20
21
22
23

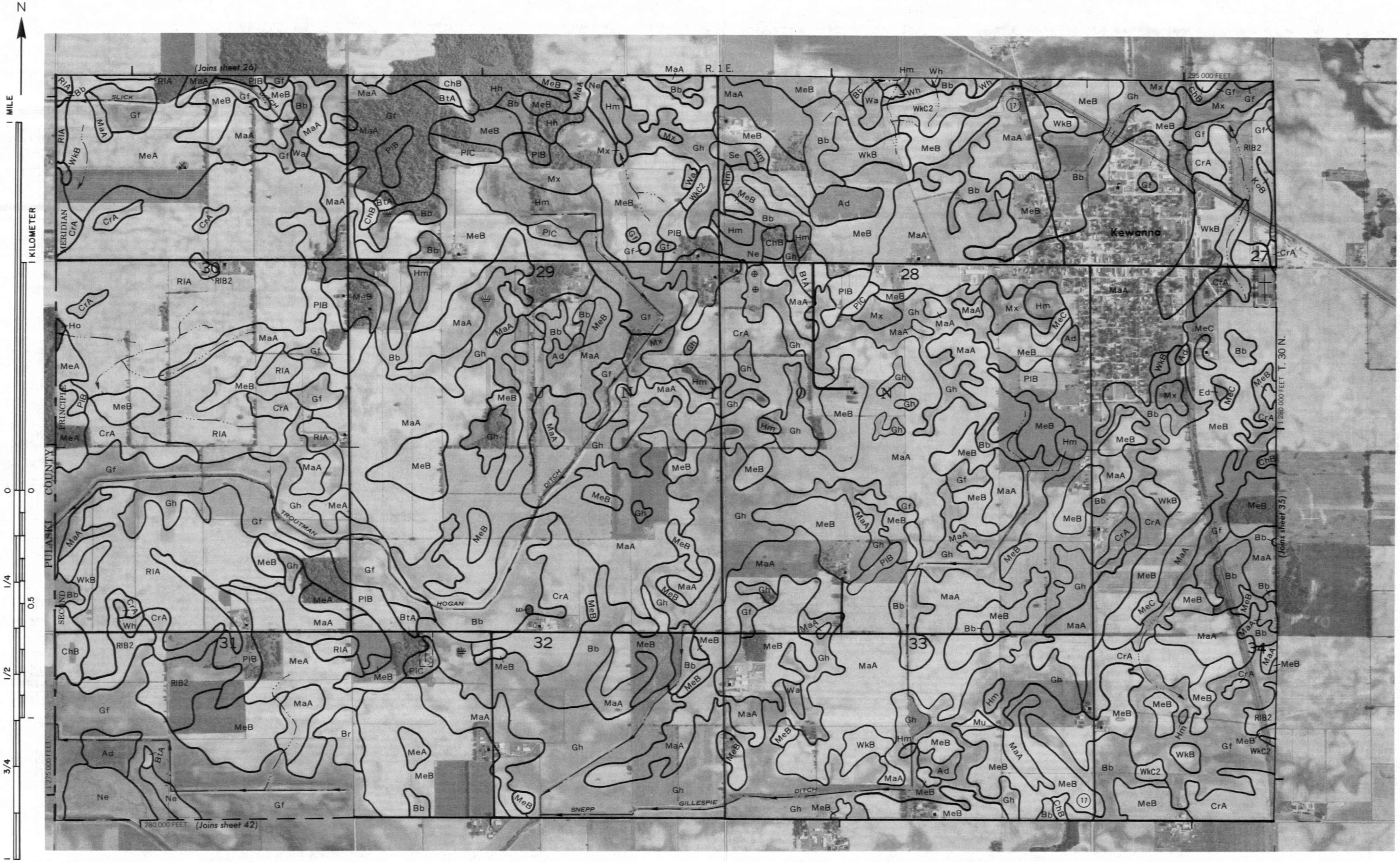

29
N
(Joins sheet 22)
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 37)
R. 2 E.
R. 3 E.
T. 30 N.
335 000 FEET
350 000 FEET
1 295 000 FEET
1 285 000 FEET
Shakey Lake
ROCHESTER
WALTERS DITCH
ROBBINS
NEFF DITCH
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
13
14
17
18
19
20
23
24
33
34

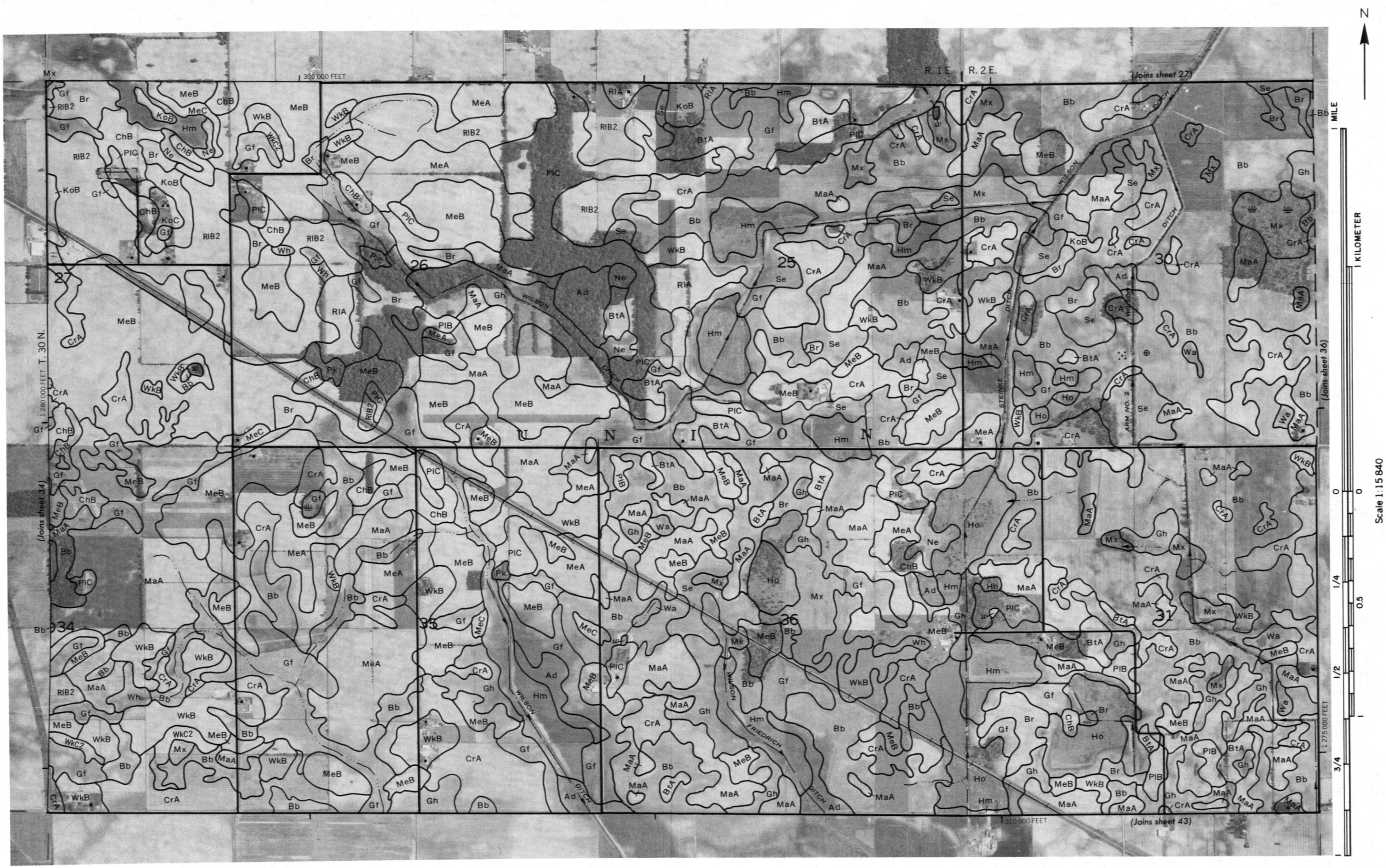
FULTON COUNTY, INDIANA — SHEET NUMBER 30

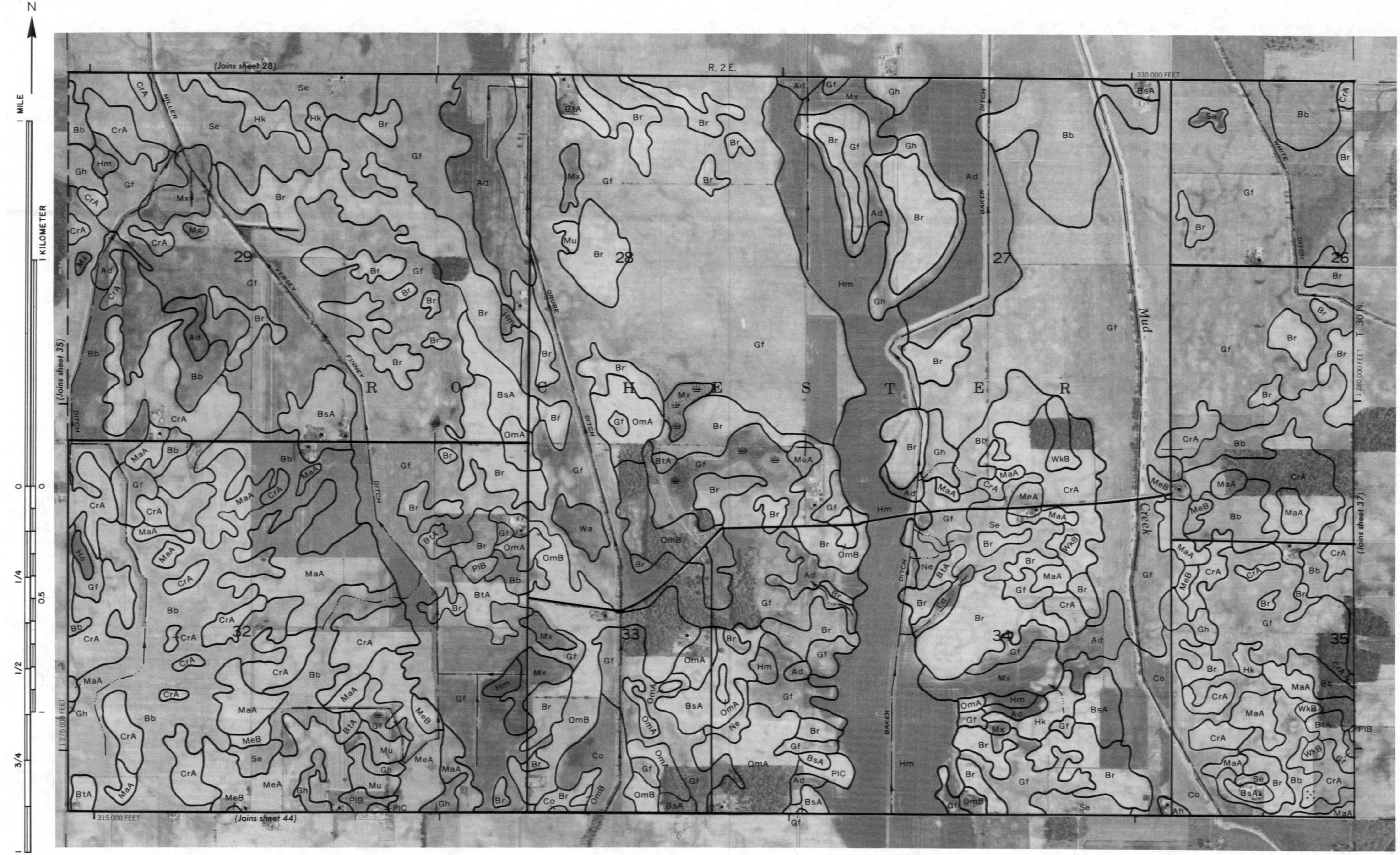

31
N
(Joins sheet 24)
(Joins sheet 32)
(Joins sheet 39)
(Joins sheet 30)
R. 3 E.
R. 4 E.
T. 30 N.
Athens
Lake Chippewa
Chippewanuck Creek
GRAHAM DITCH
ROUND ... DITCH
CURTIS
MANITOULAR DITCH
HENRY
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
370 000 FEET
385 000 FEET
390 000 FEET
2 280 000 FEET


N
MILE
KILOMETER
0
1/4
1/2
3/4
1
0.5
(Joins sheet 25)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 40)
R. 4 E.
R. 5 E.
405 000 FEET
1 295 000 FEET
1 285 000 FEET
390 000 FEET
T. 30 N.
KOSCIUSKO COUNTY
Chippewanuck Creek
CURTIS DITCH
HENRY
Akron
Town Lake
water
15
14
13
22
23
24
19

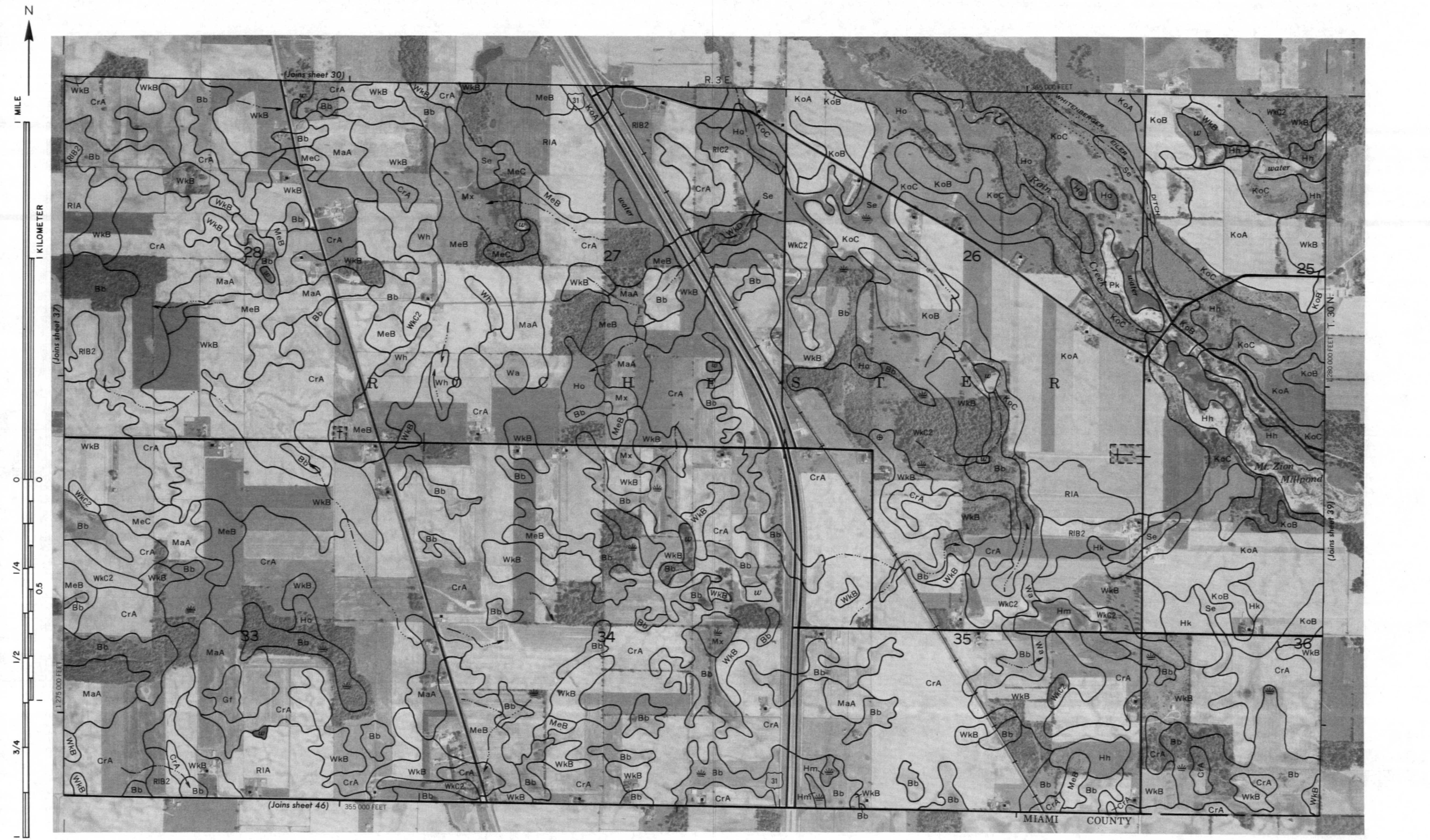

N
R. 5 E.
410 000 FEET
1 295 000 FEET
T. 30 N.
KOSCIUSKO COUNTY
WABASH COUNTY
Rock Lake
Mud Lake
Summit Lake
LAUTZENHEIZER
H
E
N
R
Y
19
20
21
22
114
(Joins sheet 32)
(Joins sheet 41)
420 000 FEET
290 000 FEET
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1

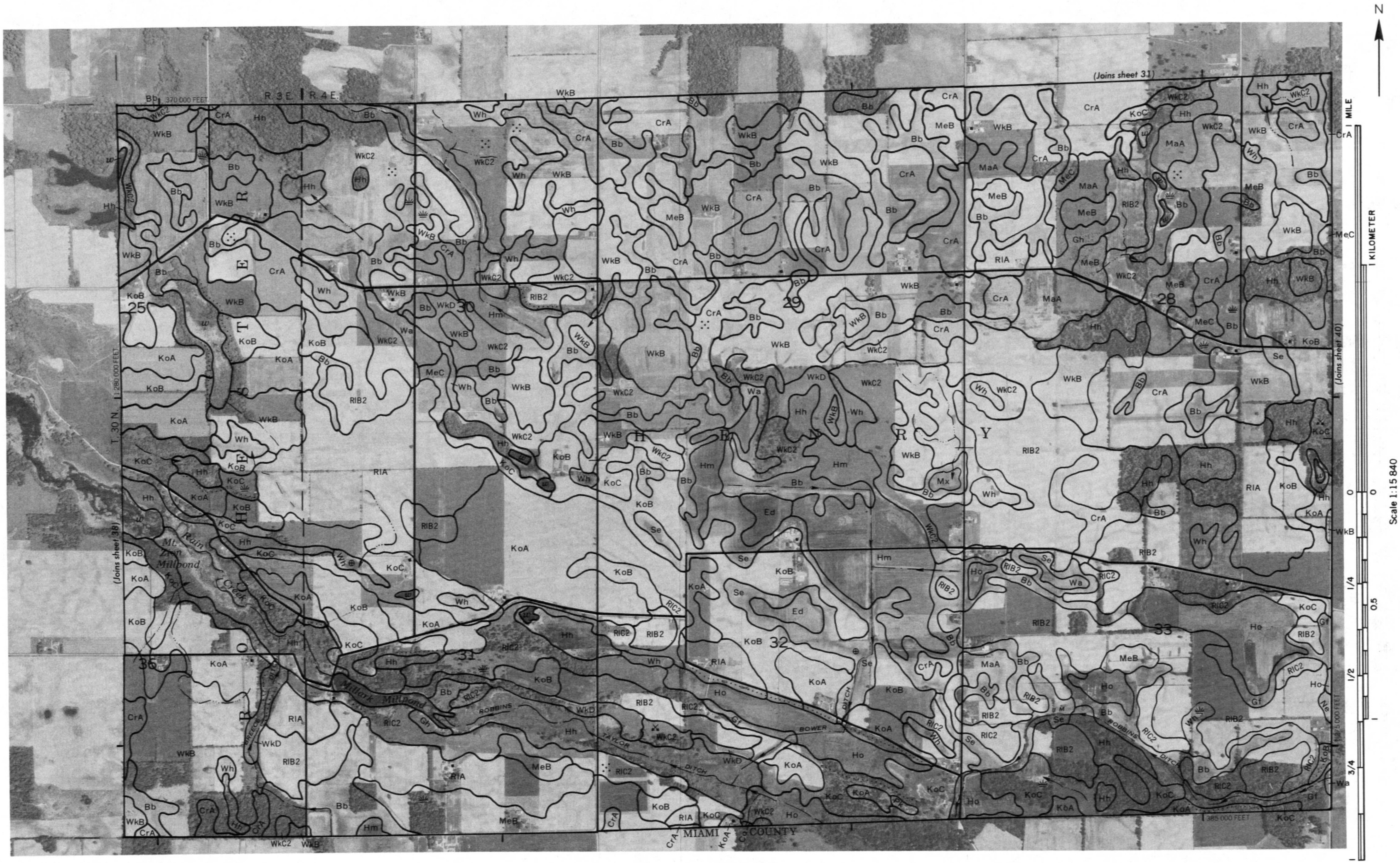

N
1 MILE
1 KILOMETER
(Joins sheet 26)
R. 1 E.
T. 30 N.
(Joins sheet 35)
(Joins sheet 42)
Kewanna
PULASKI COUNTY
SECOND PRINCIPAL MERIDIAN
TROUTMAN
HOGAN
DITCH
SNEPP
GILLESPIE
SLICK
UNION
295 000 FEET
280 000 FEET
275 000 FEET
28
29
30
31
32
33
34
27

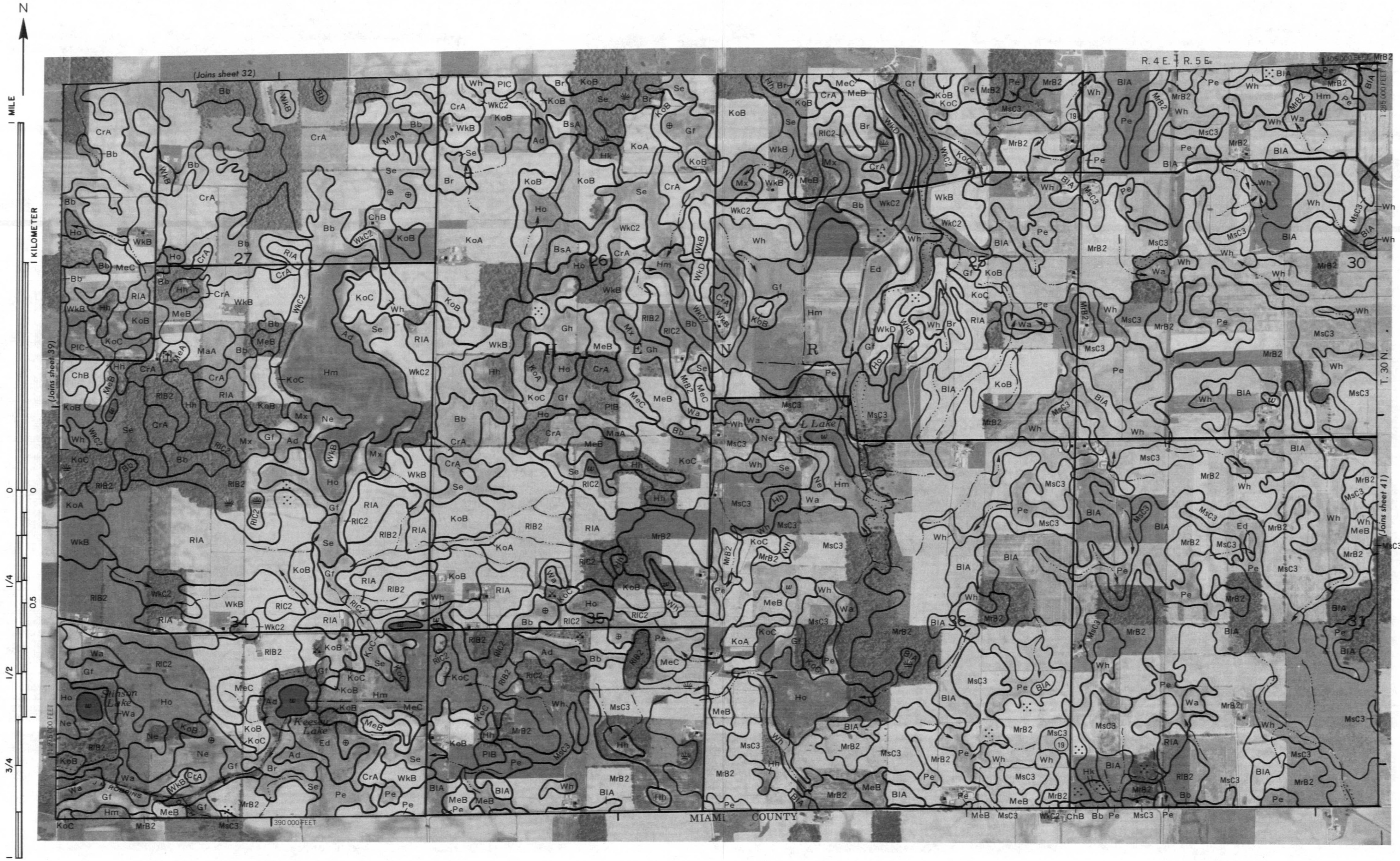

N
(Joins sheet 27)
R. 1 E.
R. 2 E.
300 000 FEET
T. 30 N.
1 280 000 FEET
(Joins sheet 34)
(Joins sheet 36)
(Joins sheet 43)
310 000 FEET
1 275 000 FEET
U N I O N
WILSON DITCH
STEINKE DITCH
ARM NO. 2
FRIEDRICH DITCH
25
26
27
30
31
34
35
36
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1


N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0
0.5
(Joins sheet 28)
R. 2 E.
330 000 FEET
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 44)
T. 30 N.
1 280 000 FEET
1 275 000 FEET
315 000 FEET
R O C H E S T E R
29
28
27
26
32
33
34
35
MILLER
KERSEY
FINNEY
DITCH
GRUBE
BAKER
WHITE
Mud
Creek

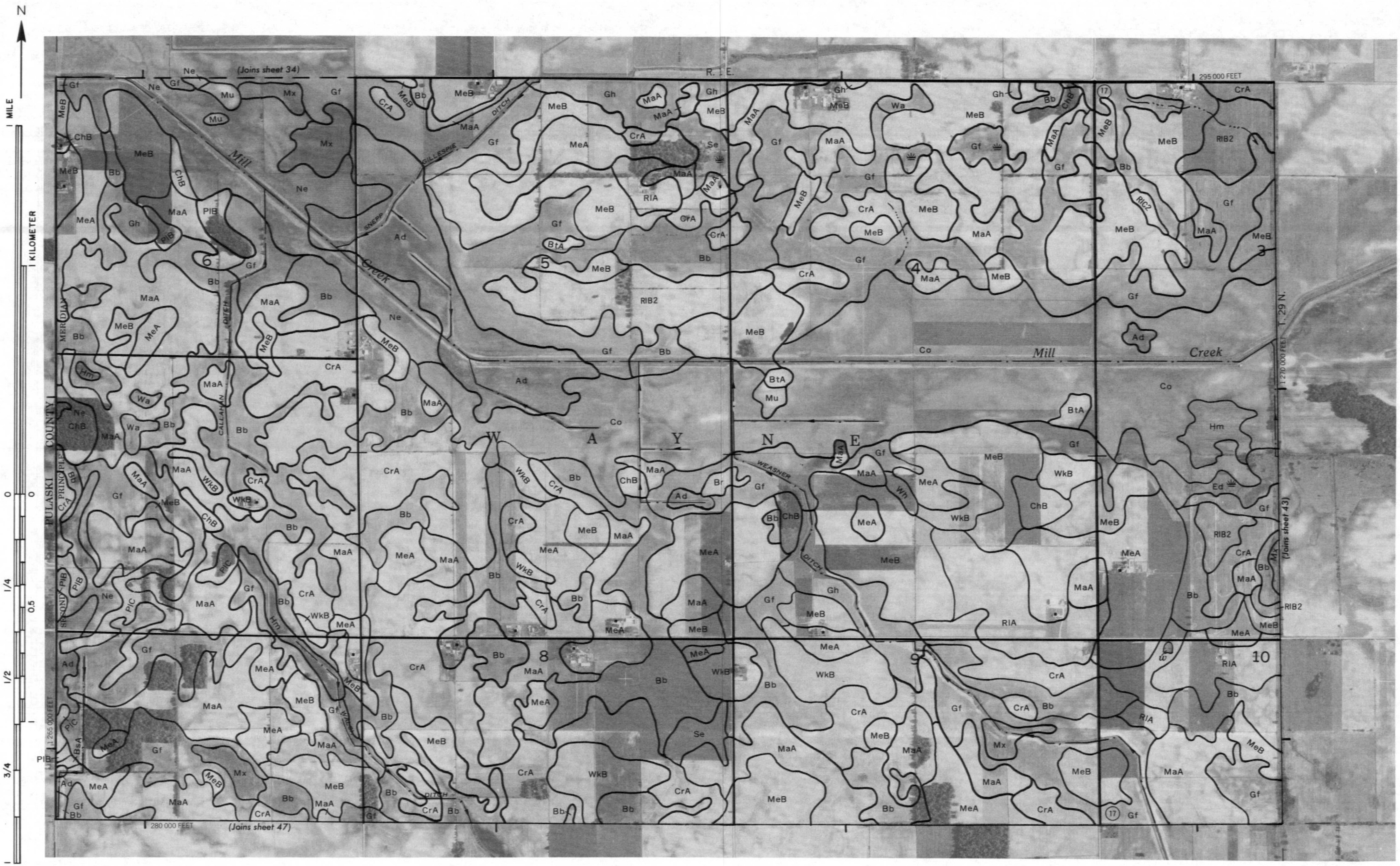

37
N
(Joins sheet 29)
(Joins sheet 38)
(Joins sheet 45)
(Joins sheet 36)
R. 2 E.
R. 3 E.
T. 30 N.
335 000 FEET
350 000 FEET
1 280 000 FEET
1 275 000 FEET
WHITE DITCH
NEFF DITCH
DITCH
WERNER
R O C H E S T E R
26
25
30
35
29
36
31
32
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

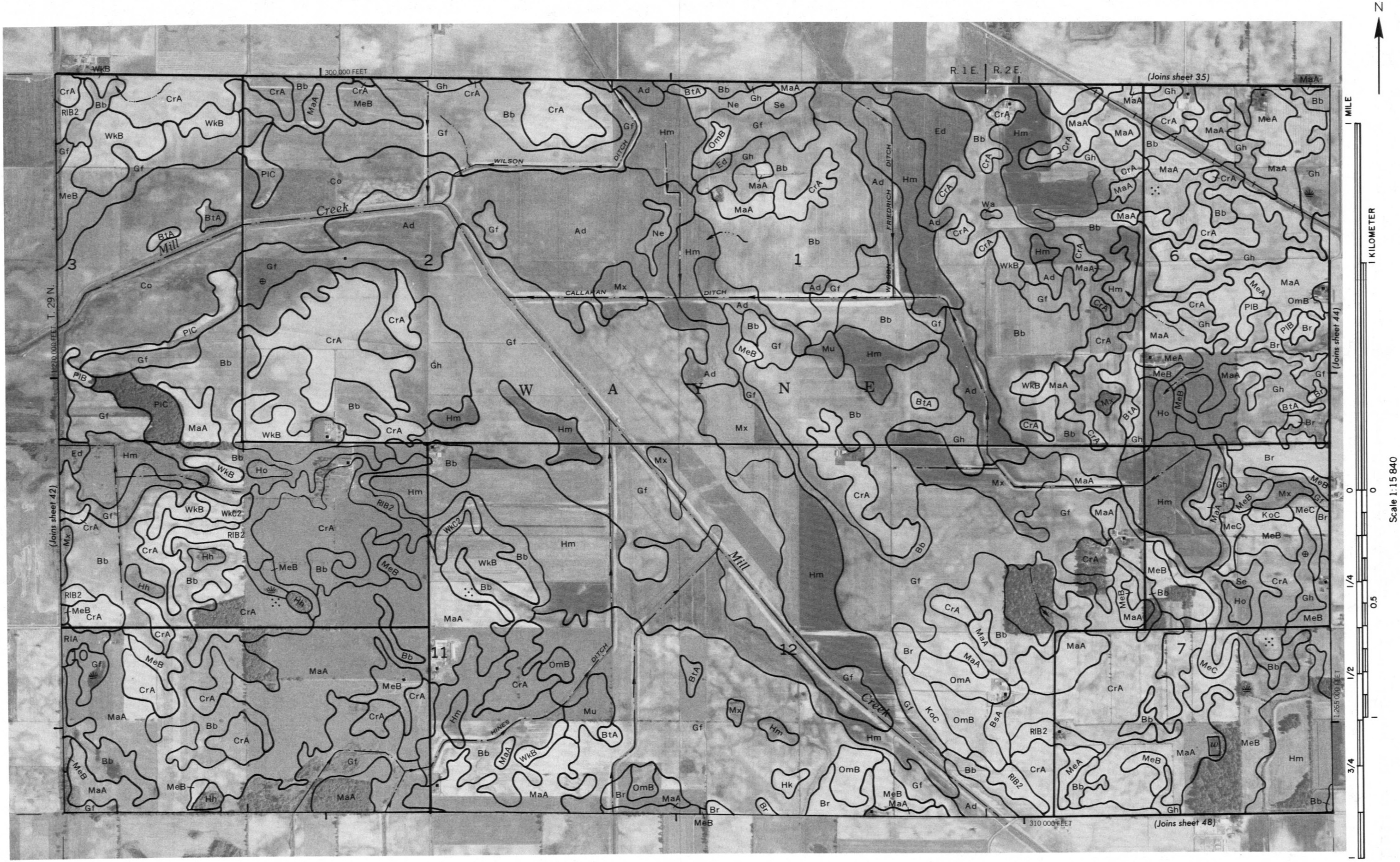

N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
(Joins sheet 30)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 46)
R. 3 E.
T. 30 N.
355 000 FEET
280 000 FEET
1 275 000 FEET
R O C H E S T E R
MIAMI COUNTY
Rain Creek
Whitenberger Eiler Ditch
Mt. Zion Millpond
25
26
27
28
33
34
35
36

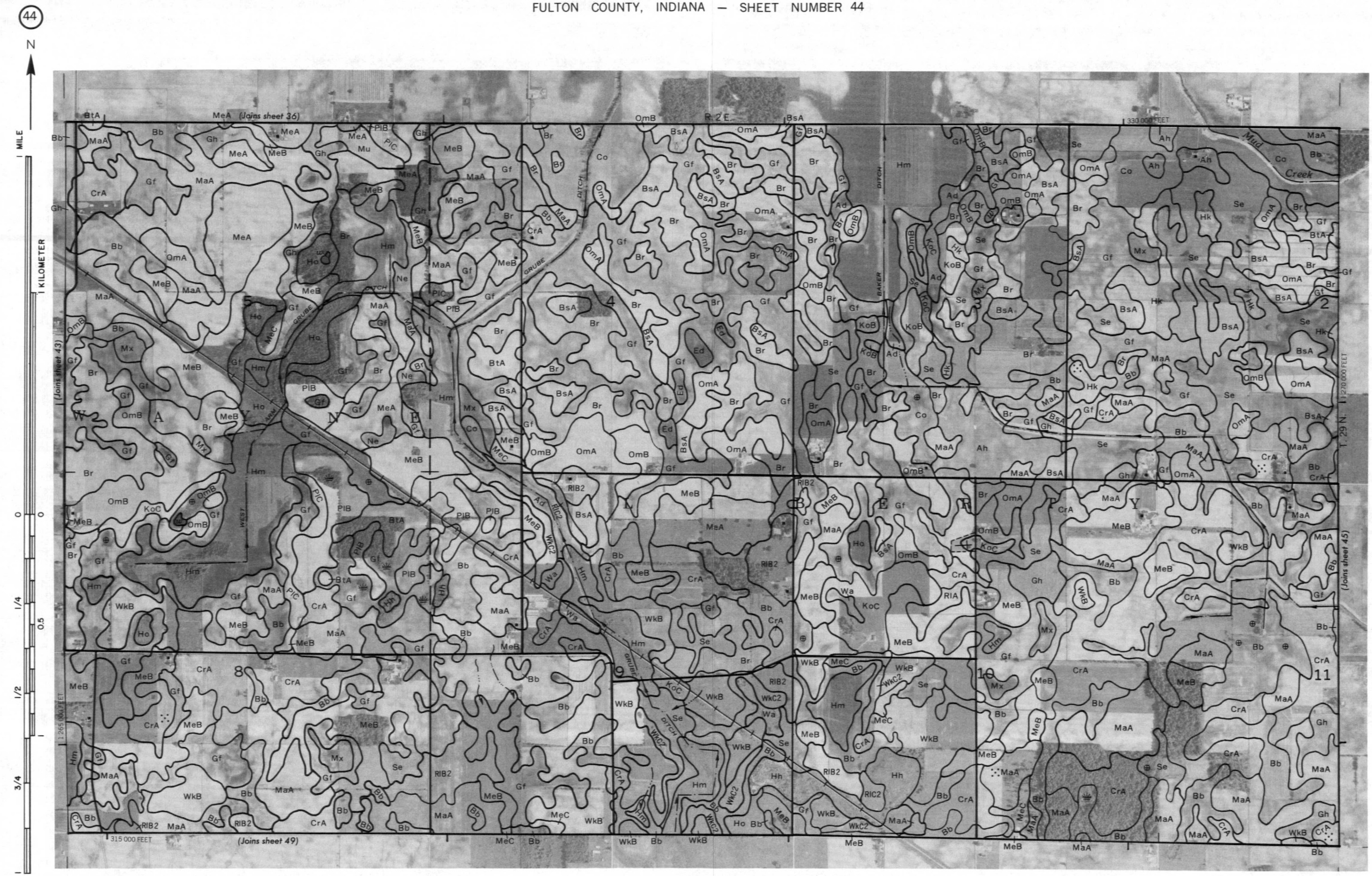

N
(Joins sheet 31)
(Joins sheet 40)
(Joins sheet 38)
R 3 E.
R 4 E.
T. 30 N.
370 000 FEET
385 000 FEET
1 280 000 FEET
1 265 000 FEET
H E N R Y
R E T H E R
Mt. Zion Millpond
Rain Creek
Millark Millpond
ROBBINS
TAYLOR DITCH
BOWER DITCH
ROBBINS DITCH
MIAMI COUNTY
25
30
29
28
36
31
32
33
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:15 840

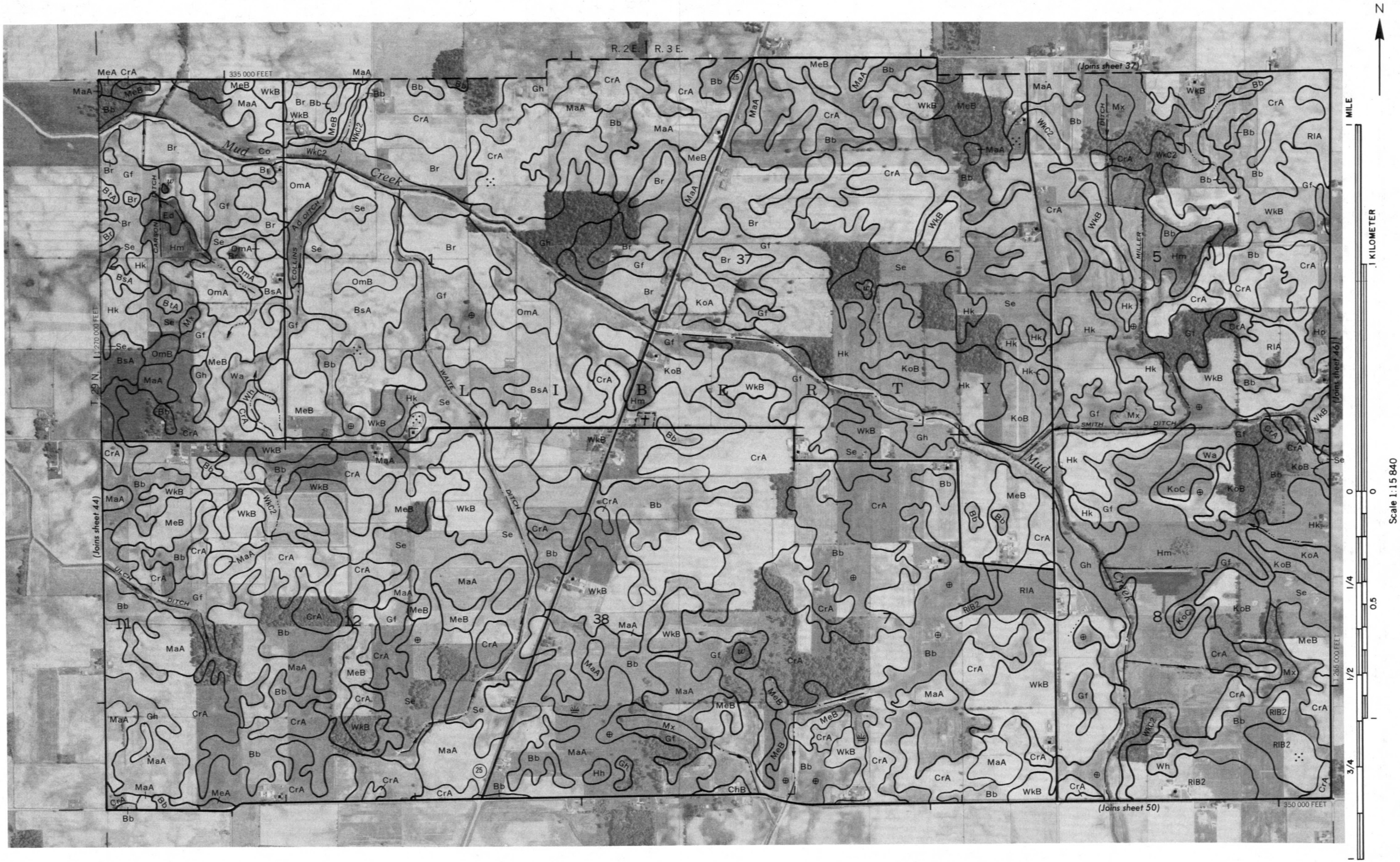

N
MILE
KILOMETER
(Joins sheet 32)
(Joins sheet 39)
(Joins sheet 41)
R. 4 E. | R. 5 E.
T. 30 N.
27
26
25
30
34
35
36
31
L Lake
Stinson Lake
Keesey Lake
MIAMI COUNTY
390 000 FEET

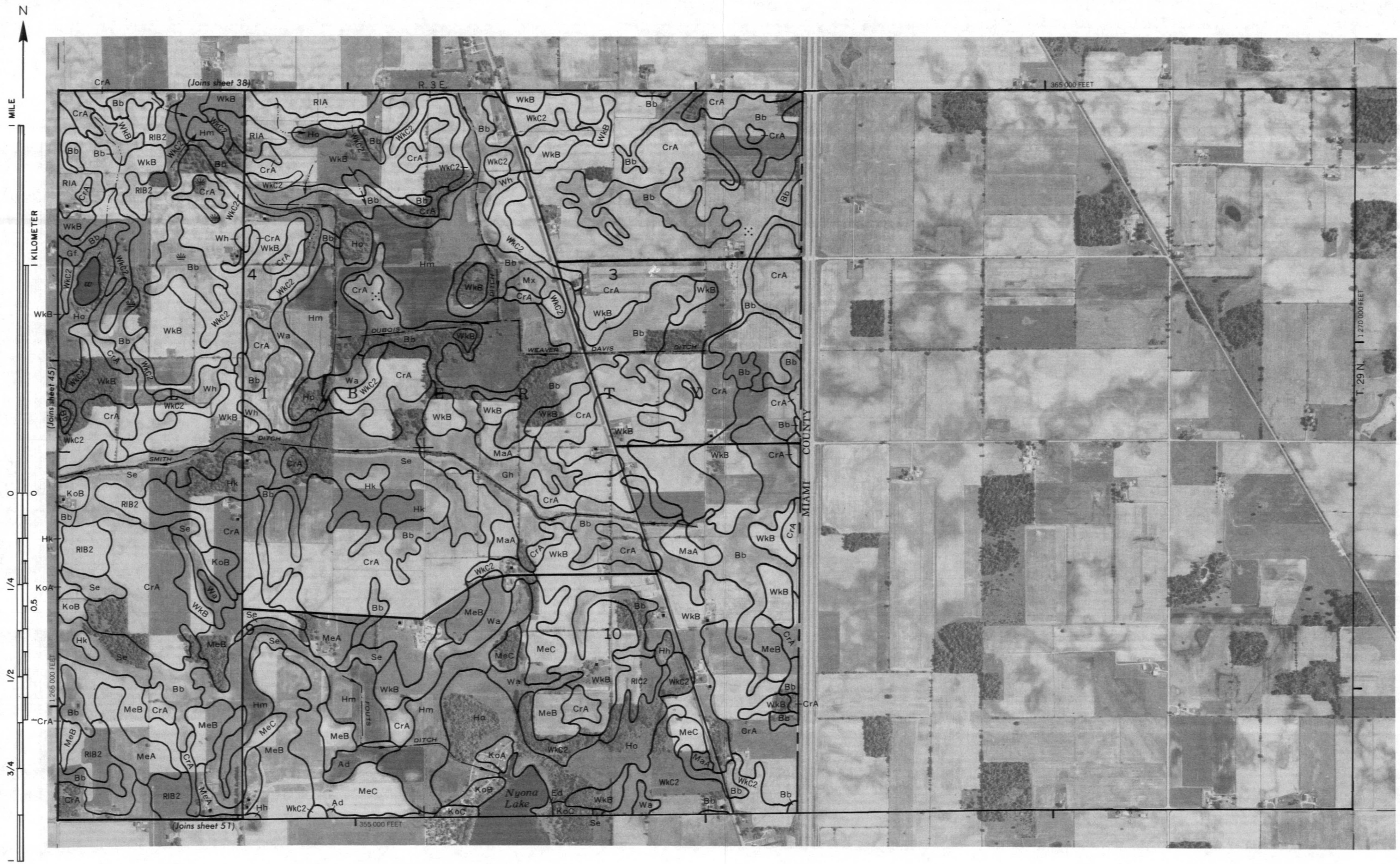

N
(Joins sheet 33)
(Joins sheet 40)
R. 5 E.
T. 30 N.
Upper Summit Lake
Lost Lake
Landis Lake
H E N R Y
MIAMI COUNTY
WABASH COUNTY
1 MILE
1 KILOMETER
Scale 1:15 840
510 000 FEET
420 000 FEET
1 285 000 FEET

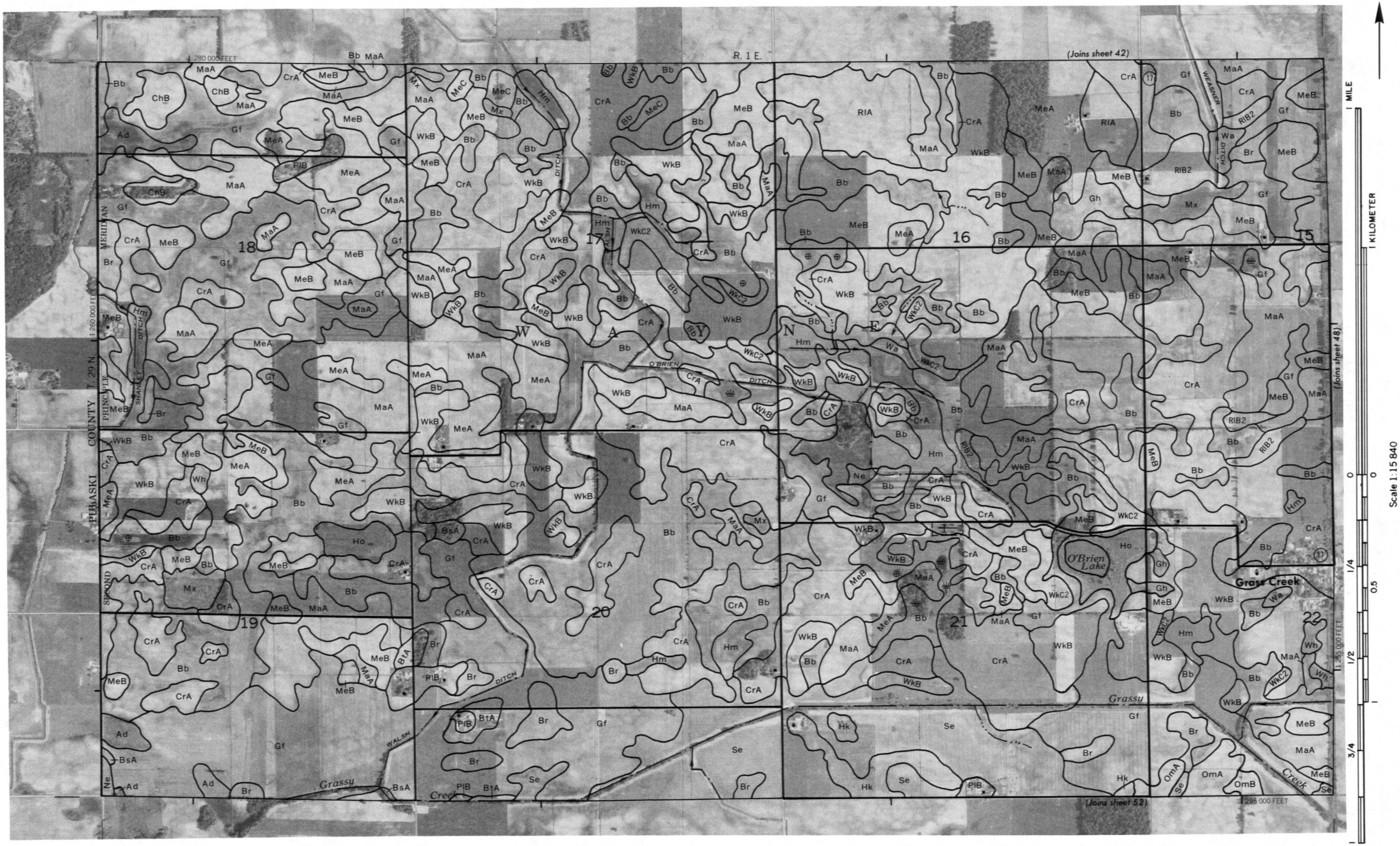

N
MILE
KILOMETER
0
1/4
1/2
3/4
0.5
(Joins sheet 34)
(Joins sheet 43)
(Joins sheet 47)
R. 1 E.
T. 29 N.
295 000 FEET
280 000 FEET
1 270 000 FEET
1 265 000 FEET
Mill Creek
Mill Creek
W A Y N E
PULASKI COUNTY
SECOND PRINCIPLE MERIDIAN
GILLESPIE DITCH
CALLAHAN DITCH
WEASNER DITCH


N
300 000 FEET
R. 1 E.
R. 2 E.
(Joins sheet 35)
(Joins sheet 44)
(Joins sheet 42)
(Joins sheet 48)
310 000 FEET
1 270 000 FEET
1 265 000 FEET
T. 29 N.
WILSON
DITCH
CALLAHAN
FRIEDRICH
HINES
Mill
Creek
W A Y N E
1
2
3
6
7
11
12
MILE
KILOMETER
Scale 1:15 840

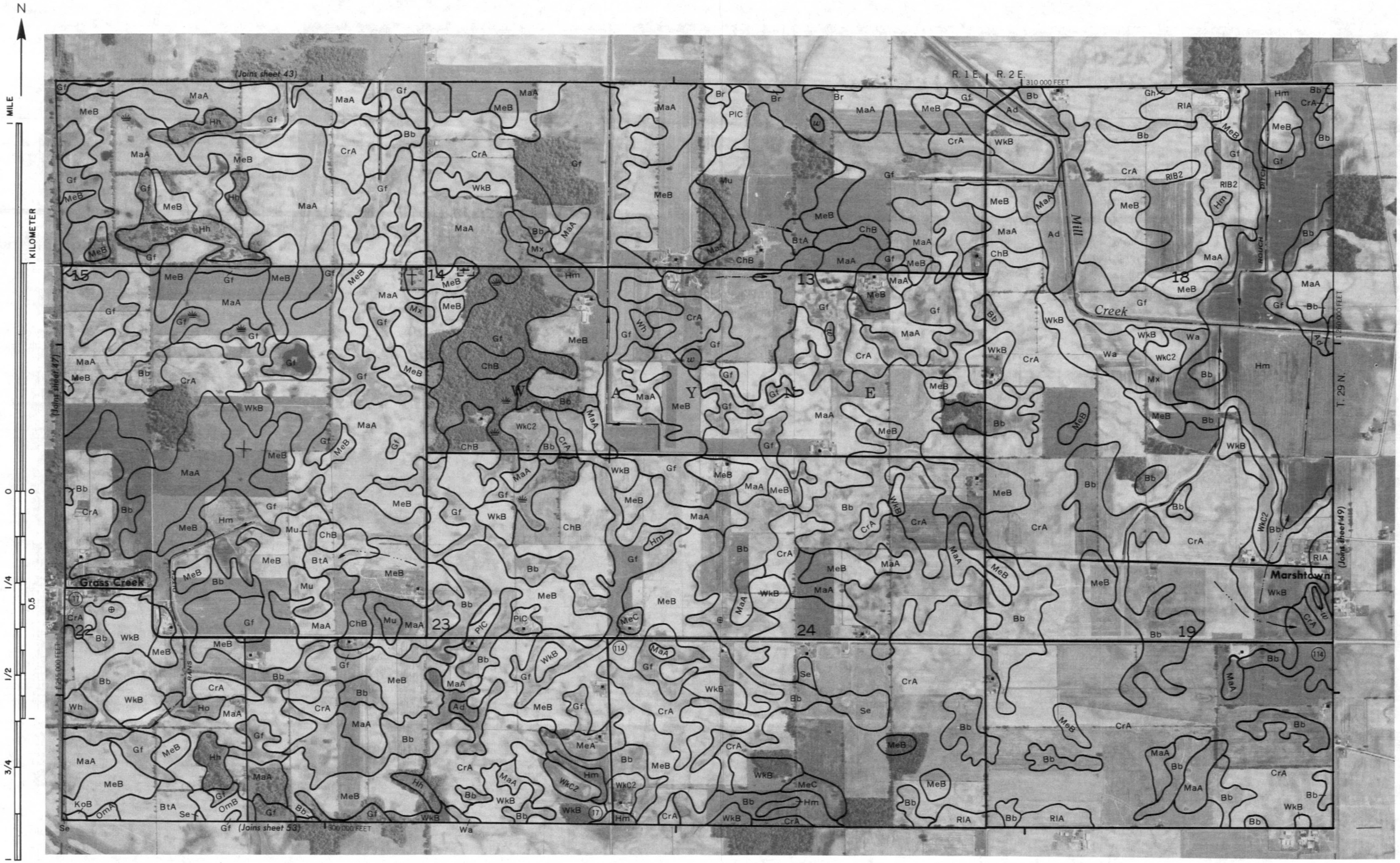

44
N
MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
(Joins sheet 36)
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 49)
R. 2 E.
T. 29 N.
330 000 FEET
1 220 000 FEET
1 265 000 FEET
315 000 FEET
Mud Creek
WAYNE
LIBERTY

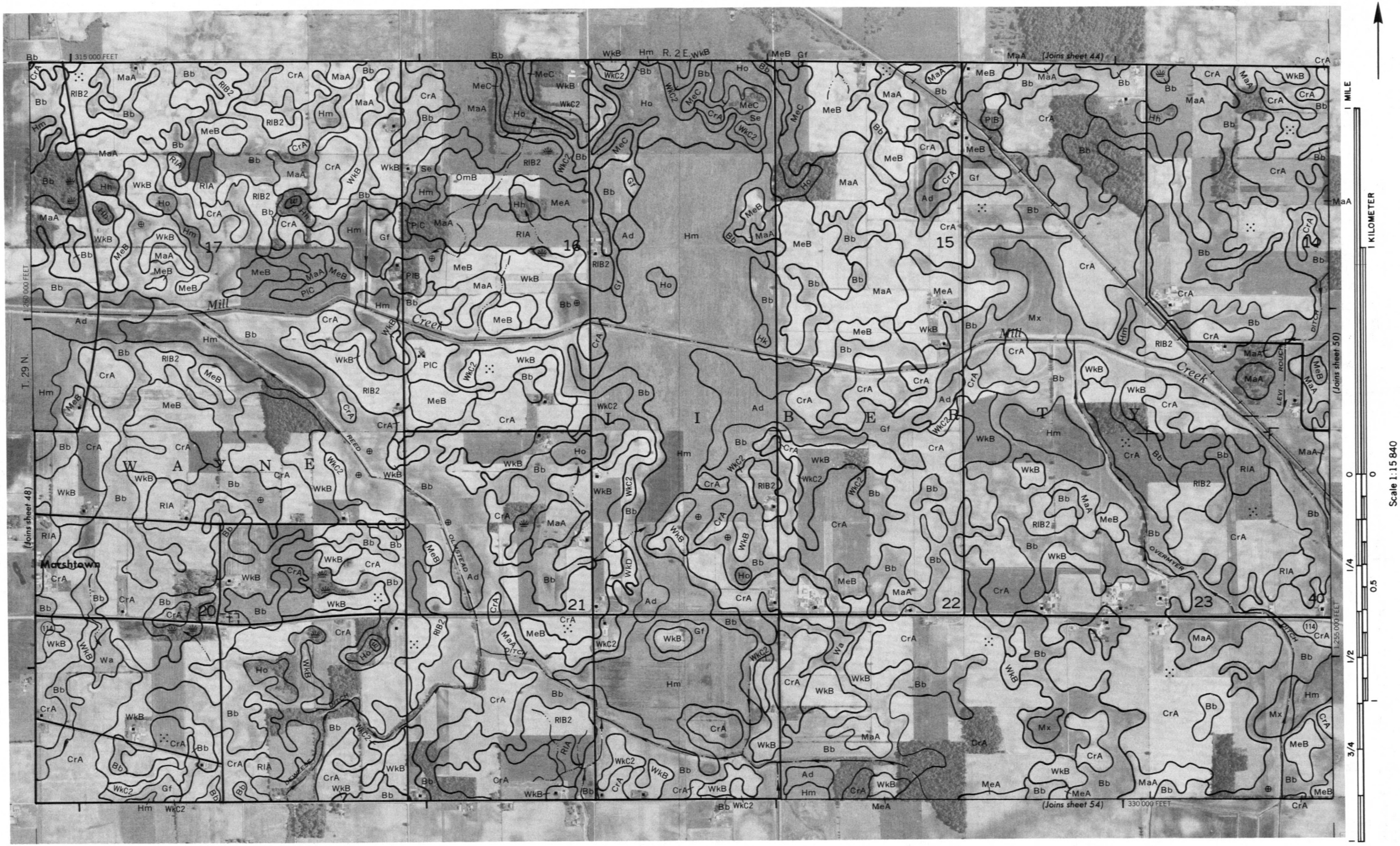

N
R. 2 E. | R. 3 E.
335 000 FEET
(Joins sheet 37)
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 50)
1 270 000 FEET
1 265 000 FEET
350 000 FEET
T. 29 N.
Mud Creek
CARSON DITCH
COLLINS DITCH
WAITE DITCH
MILLER DITCH
SMITH DITCH
LIBERTY
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
0.5
1/2
3/4
1
6
5
37
11
12
38
7
8
25
CrA
MaA
MeB
WkB
Bb
Br
Gf
Se
Hk
KoB
OmA
BsA
RlA
RlB2
Mx
Hm
Gh

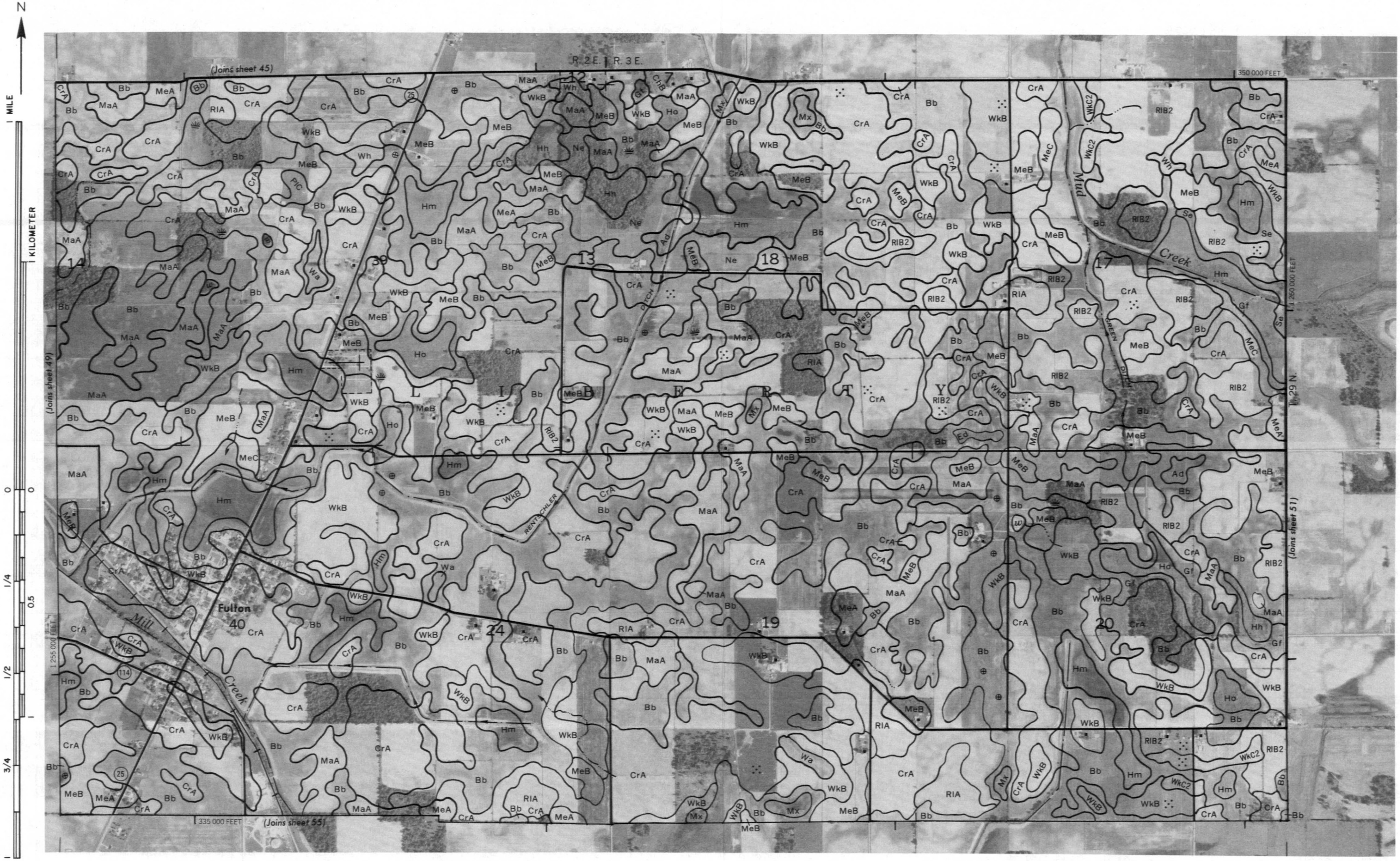

N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
(Joins sheet 38)
(Joins sheet 45)
(Joins sheet 51)
R. 3 E.
T. 29 N.
365 000 FEET
1 270 000 FEET
355 000 FEET
1 255 000 FEET
MIAMI COUNTY
L I B E R T Y
DUBOIS
WEAVER
DAVIS
DITCH
SMITH
FOUTS
Nyona Lake
4
3
9
10


(Joins sheet 42)
(Joins sheet 48)
(Joins sheet 52)
R. 1 E.
T. 29 N.
PULASKI COUNTY
PRINCIPAL MERIDIAN
WAYNE
O'Brien Lake
Grass Creek
N
Scale 1:15 840
1 MILE
1 KILOMETER

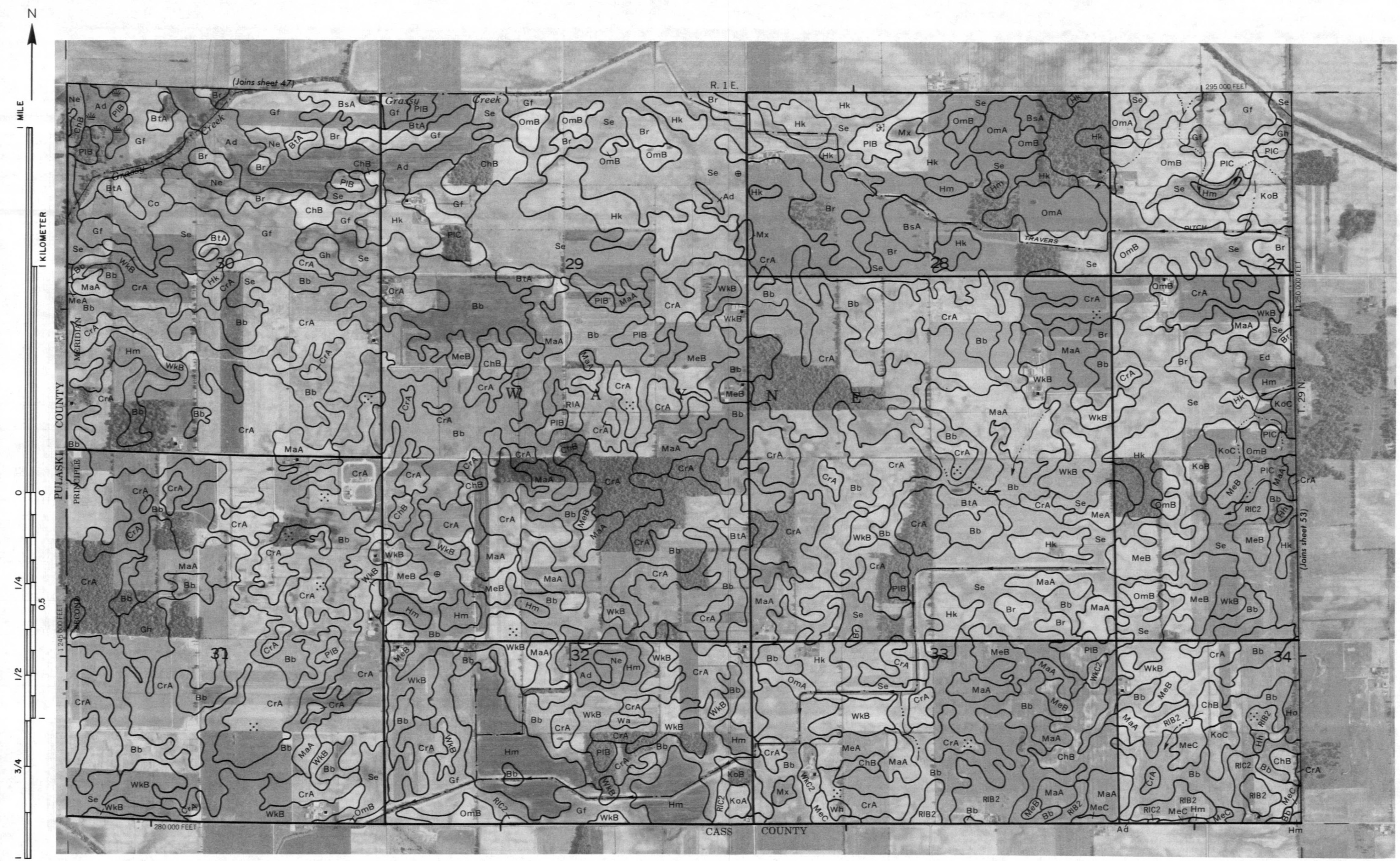
FULTON COUNTY, INDIANA — SHEET NUMBER 48

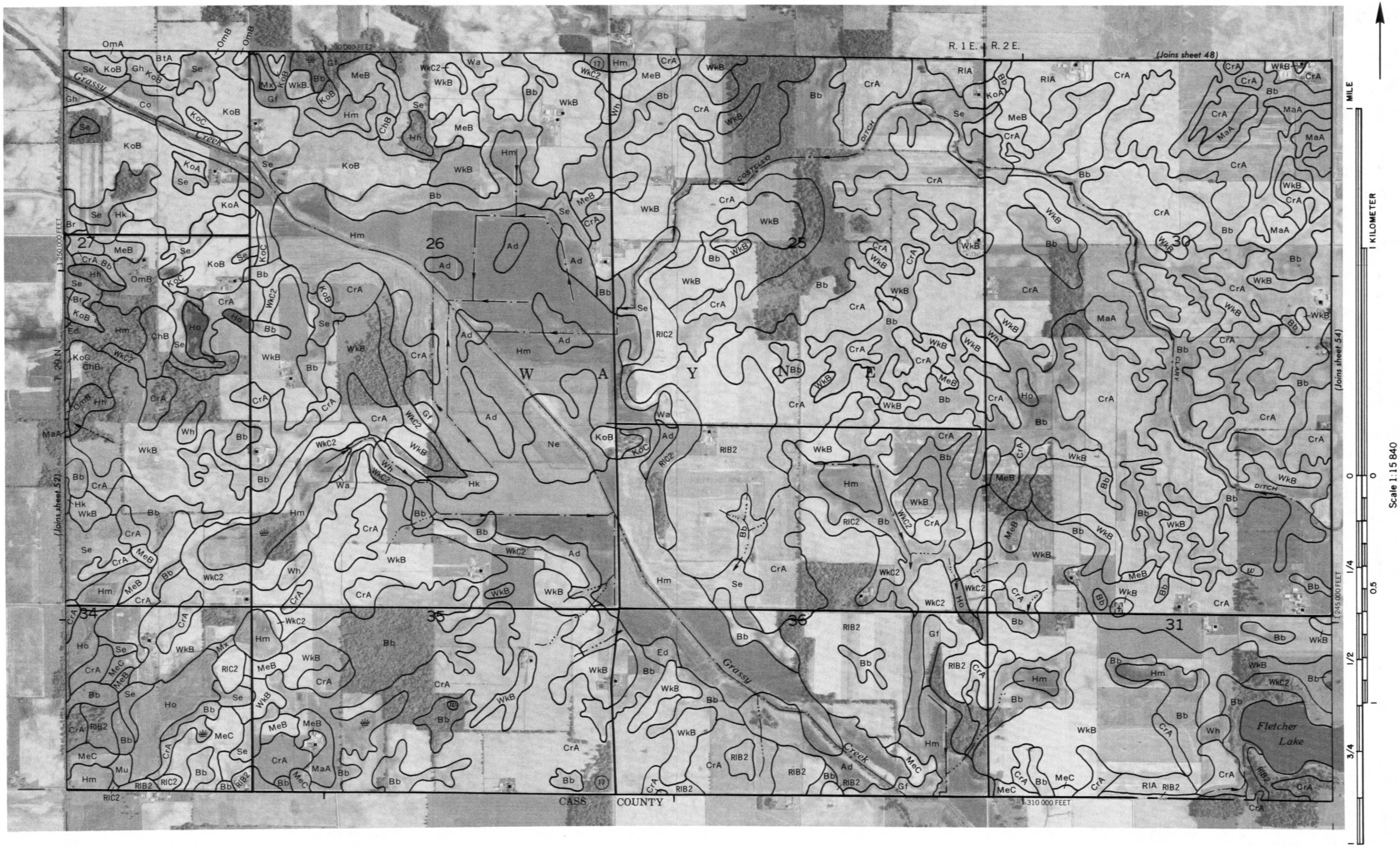



R. 2 E.
T. 29 N.
(Joins sheet 44)
(Joins sheet 48)
(Joins sheet 50)
(Joins sheet 54)
315 000 FEET
330 000 FEET
Marshtown
WAYNE
LIBERTY
Mill Creek
1 MILE
1 KILOMETER
Scale 1:15 840
N

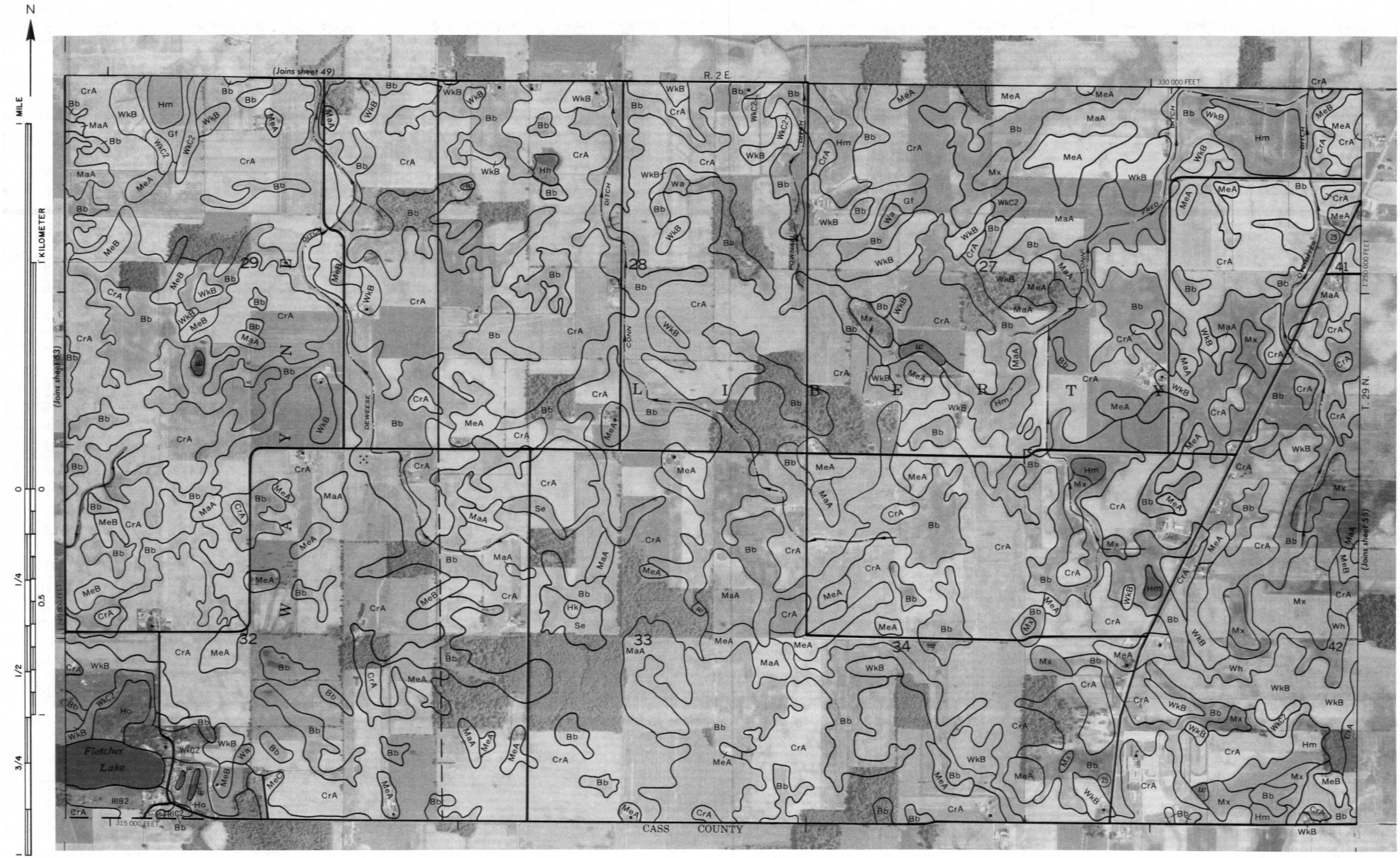

N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
(Joins sheet 45)
R. 2 E. | R. 3 E.
350 000 FEET
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 55)
335 000 FEET
1 255 000 FEET
1 260 000 FEET
T. 29 N.
L I B E R T Y
Fulton
Mill Creek
Mud Creek
RENTSCHLER DITCH
GREEN DITCH
12
7
14
39
13
18
17
40
24
19
20

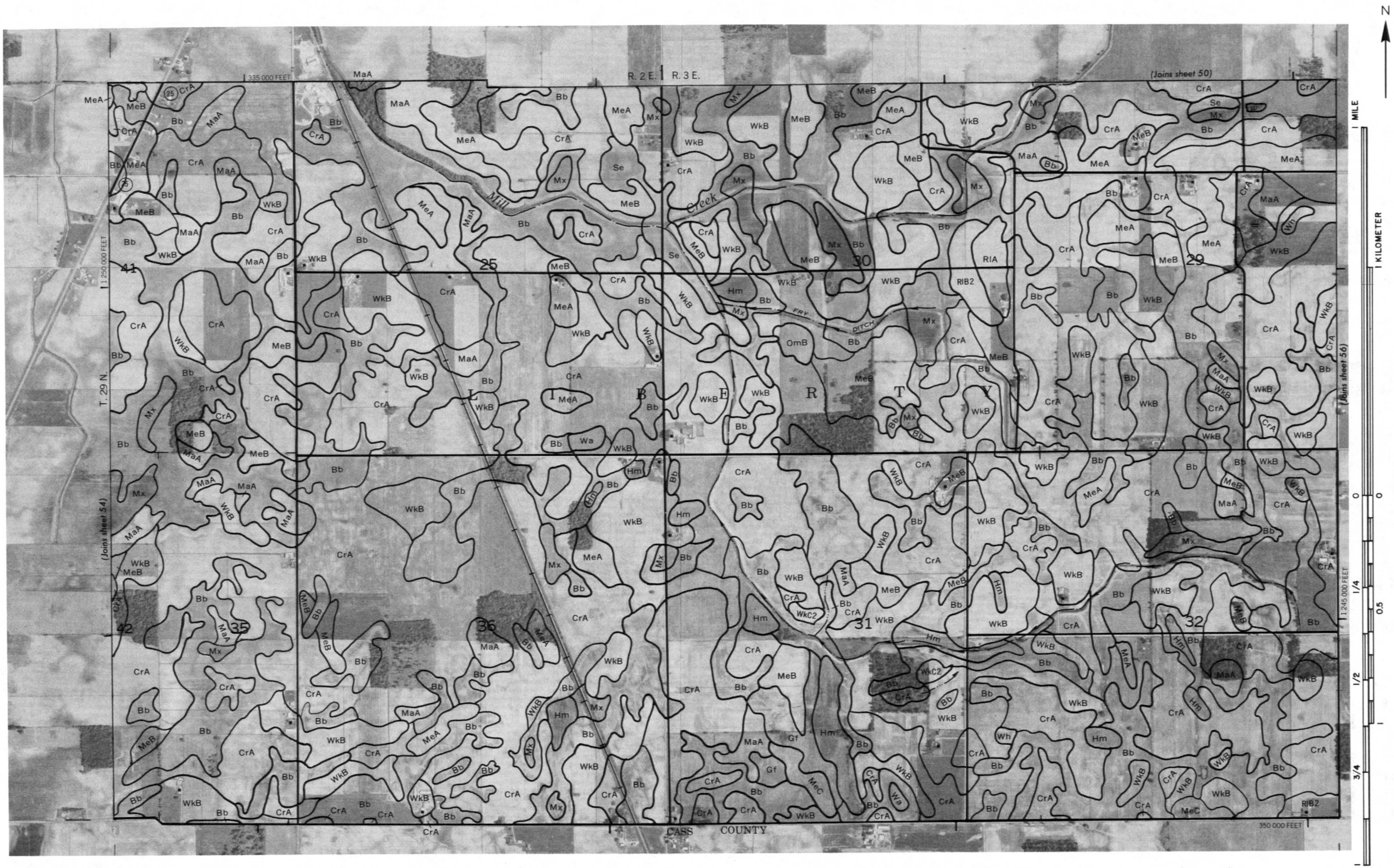

N
(Joins sheet 46)
(Joins sheet 50)
(Joins sheet 56)
355 000 FEET
R. 3 E.
T. 29 N.
Nyona Lake
South Mud Lake
Mud Creek
South Branch
L I B E R T Y
MIAMI COUNTY
WHITMORE DITCH
RANNELLS DITCH
ZANGER DITCH
SMITH DITCH
16
15
21
22
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:15 840


N
MILE
KILOMETER
0
1/4
1/2
3/4
1
0.5
(Joins sheet 47)
R. 1 E.
295 000 FEET
1 250 000 FEET
T. 29 N.
(Joins sheet 53)
1 245 000 FEET
280 000 FEET
PULASKI COUNTY
SECOND PRINCIPLE MERIDIAN
Grassy Creek
TRAVERS DITCH
W A Y N E
CASS COUNTY
30
29
28
27
31
32
33
34


N
R. 1 E. | R. 2 E.
(Joins sheet 48)
(Joins sheet 52)
(Joins sheet 54)
T. 29 N.
CASS COUNTY
Grassy Creek
COSTELLO DITCH
CLARY DITCH
Fletcher Lake
W A Y N E
26
25
30
27
34
35
36
31
300 000 FEET
310 000 FEET
250 000 FEET
245 000 FEET
1 MILE
1 KILOMETER
Scale 1:15 840

FULTON COUNTY, INDIANA — SHEET NUMBER 54




N
(Joins sheet 50)
R. 2 E.
R. 3 E.
335 000 FEET
1 250 000 FEET
1 245 000 FEET
350 000 FEET
T. 29 N.
(Joins sheet 54)
(Joins sheet 56)
L I B E R T Y
Mill Creek
FRY DITCH
CASS COUNTY
25
30
29
41
42
35
36
31
32
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:15 840

FULTON COUNTY, INDIANA — SHEET NUMBER 56